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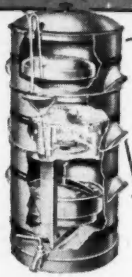

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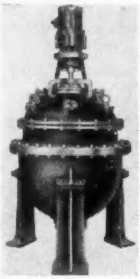

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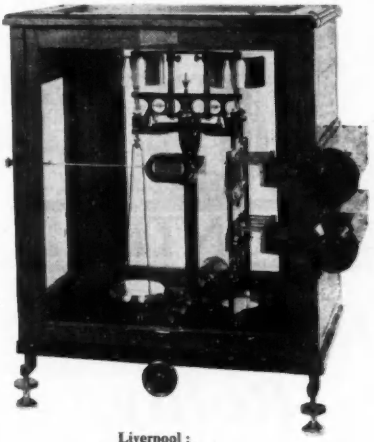

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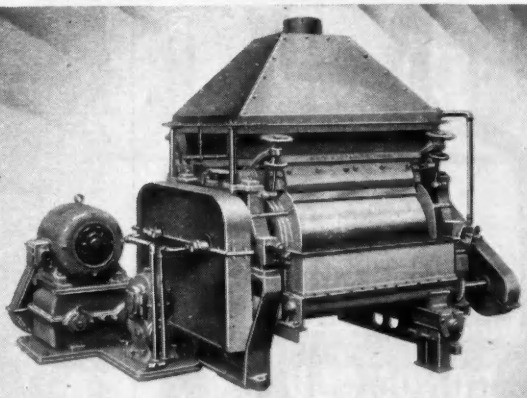

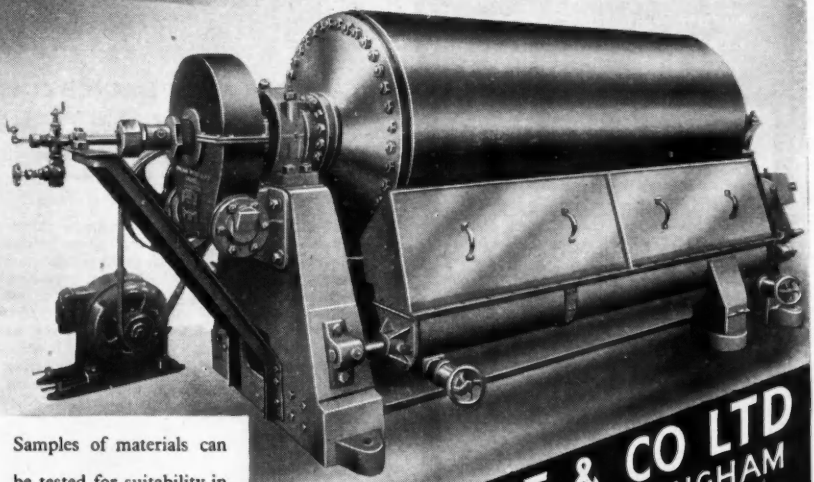

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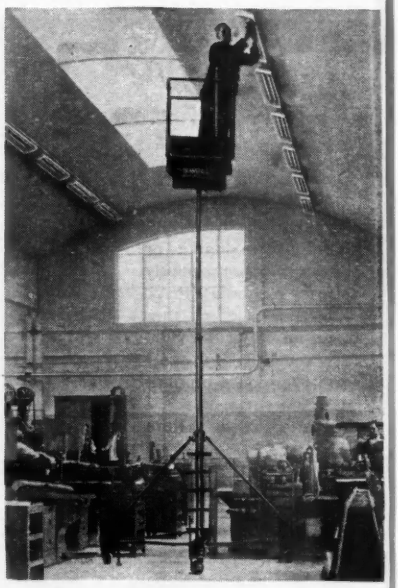

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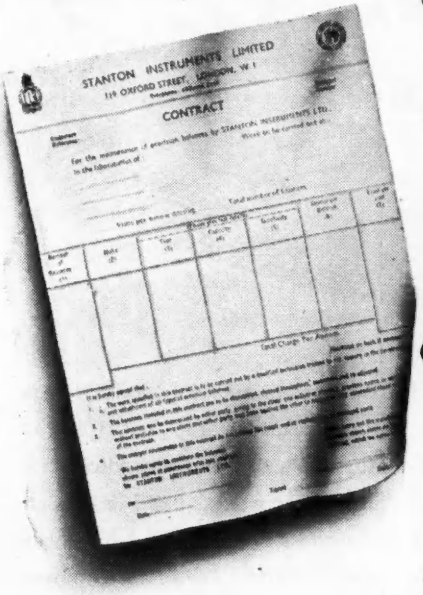
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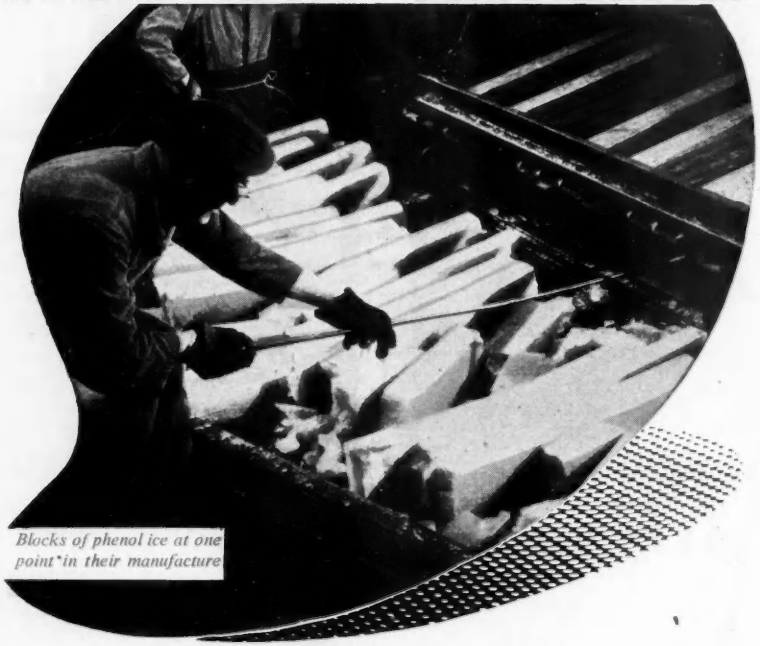

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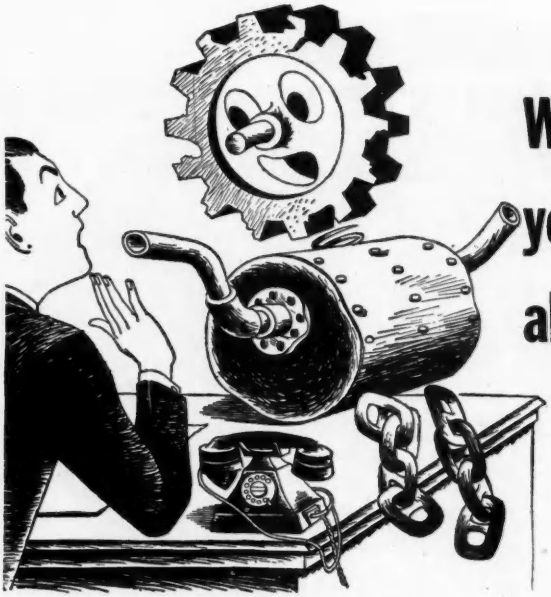

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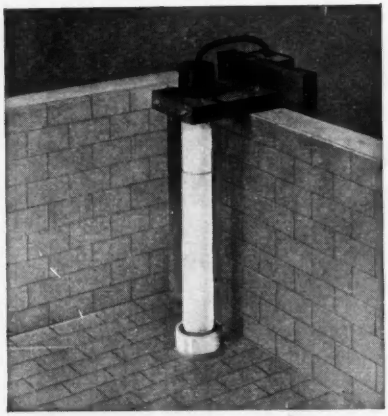

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Volume LXIV 26 May 1951 Number 1663

Measure for Measure

IT is not so many decades ago that a Chancellor of the Exchequer spontaneously summed up the British people's attitude to the metric system of weights and measures. Involved in no little difficulty explaining figures prepared for him by the Treasury, he was heard to mutter: 'It's not the noughts that are the trouble, it's the damned dots!' The Committee on Weights and Measures Legislation in its recent Report (HMSO, May 1951) has concluded that a change from the imperial system to the metric system is sooner or later inevitable for all trade purposes and that the Government should start taking steps that will eventually abolish the imperial system in Britain. Nevertheless, evidence obtained for the Committee by women's organisations has clearly shown that on the whole the purchasing public would be opposed to the abolition of the weights and measures system now in common use, and even bodies of opinion strongly in favour of 'decimalisation' admit that a complete change-over would have to be gradually made over a period of at least twenty years. In its suggestions how the change could be brought about, the Committee emphasises that there must be 'a lengthy process of preparing the general public for the change'.

Most scientists and technologists will be ready supporters of the metric system. In their training and in their daily work they use the metric system; though in doing so they probably do not realise that at one time this was *not* a legally permissive option. Indeed, scientists are so metrically conditioned that they can make embarrassingly simple mistakes when presenting their work in imperial terms for non-scientists. Within technology itself clashes between the two systems tend to occur where chemistry impinges upon engineering; for engineering has largely kept to the imperial system and engineers have overcome their greater burden of calculations by welding themselves to slide-rules. The amount of mental effort that is spent each day in Britain and the Commonwealth upon imperial system calculations must constitute a huge total of waste. It is not as if the imperial system offers consistency even within its own territory. And although a major group—Britain, the Commonwealth, and the U.S.A.—adhere to imperial weights and measures, there are differences in their 'imperialism'. The U.S. ton is 2,000 pounds, not our 2,240; a partial move towards metric simplicity. Cent and dollar coinage relationships have a metric quality that we have long denied to pounds, shillings, and pence. Even when the same imperial units of weight or measure are used in

these countries, there are in many cases slight but increasingly important differences between official standards. The British inch is equivalent to 25.39993 mm.—the U.S. legal standard is 25.4005 mm. Such divergences may seem minute, but they can be significant in high precision engineering.

The metric system, used by the great majority of countries, is compact, closely defined, and universally recognised. It could be regarded as one of France's greatest contributions to the world. It is internationally defined and standardised by the International Metric Conference. No similar organisation has come into existence to streamline the imperial system and to ensure that countries using it sink their differences.

The Committee on Weights and Measures has come down firmly and boldly on the side of the metric system. Although only a minority of countries adhere to imperial standards, their trading capacity is so large that at least half the world's total trade is measured in imperial units. This possible argument for retaining the imperial system is refuted on the grounds that the decimal system is so advantageous that no country already using it could be expected to adopt a non-decimal system. The decimalisation of the relationships between imperial system units so as to obtain one of the major benefits of the metric system without destroying the historical 'habit' of imperial names is also refuted; the Committee considers that this compromise would involve almost as much transition trouble as the complete introduction of the metric system yet without bringing in the end the benefits of world-wide uniformity. Nor has the Committee supported a third and apparently more popular argument, that so long as imperial system countries allow the optional use of the two systems the system that is the better must in the end and in its own time come into general use. This natural approach to world uniformity is likely to involve so prolonged a period of transition that a more definite and ordered transition over some fixed period such as twenty years must prove much less inconvenient. These conclusions of the Committee are admirably sound and logical.

To say all this, however, is not to ease the total task. There are grave doubts whether the present time in British history is suitable for attempting such far-reaching changes in daily customs. Whatever the commercial and technical merits may be, the main difficulties of change will fall upon the general public. Any attempt to alter the units of weight, volume, or size and the units of monetary relationships is bound to be far more unpopular and suspect than during some happier period of economic stability. This may well be a political 'imponderable' that no British government of the next five or ten years can dare to grapple with.

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Notes & Comments

The Service of Man

IS science necessarily beneficial, or has it released forces beyond its control? What are the scientists trying to do? These are some of the questions which the layman tends to ask himself when somewhat overawed by the spectacular advances of nuclear physics, and indeed the recent announcement that five per cent of American scientists and engineers are now employed on atomic energy may well cause him to wonder whether investigations should not be confined to those matters which cannot be misapplied. This was indeed one of the main points in Professor R. P. Linstead's talk on 'Chemistry and the Amenities of Life,' given at the Royal Institution on 16 May. The lecture was the first of four public lectures, 'Chemistry in the Service of Man', organised by the Chemical Council in connection with the Festival of Britain, to emphasise the part played by chemists, directly and indirectly, in the cultural, industrial and economic advances of the last century. Professor Linstead quite rightly insisted that any censorship or control of research could not be tolerated. The scientist's job was the search for truth, which must be good. Application of his discoveries was the rôle of technology. The selection of the beneficial and rejection of the harmful must ultimately be the responsibility of mankind as a whole. The professor gave a number of examples of the general amenities due to the chemist including pure water; soap and cleaning agents; synthetic fibres; and dyestuffs, in all of which Britain had played a prominent part. He concluded by stating that it was increasingly urgent to have a re-examination of human ends for direction was more important than speed. Knowledge indeed is the ultimate aim, as Bacon said, '. . . a rich storehouse, for the glory of the Creator and the relief of man's estate.'

U.S. Nylon

CURRENT raw material problems in the American chemical industry would not seem to be affecting the rapid expansion in nylon production. In 1945 one Du Pont factory was providing the total output of 20 million pounds; by 1950 three factories were able to manufacture 100 million pounds; for 1951 capacity is assessed at 170 million pounds and for 1952 or 1953 at 240 million pounds. What might have been the principal raw material shortage—benzene—has been avoided by developing the use of furfural from cereal wastes and cyclohexane from petroleum. It is one of the economic advantages of the nylon synthesis that its primary chemical processes can be based upon a small range of alternative materials. This has offset the high capital requirements of nylon production, otherwise a most dangerous economic liability should one specific material be indispensable. In fact, the four Du Pont factories now turning out nylon are operating three if not four different basic processes. In the future expansion Du Pont will no longer be exclusive manufacturers. The Chemstrand Corporation (formed by Monsanto and American Viscose) will be entering the field under licence from Du Pont before the Du Pont patent monopoly period ends. It may not be generally realised that nylon is now exceedingly 'big business' in the United States. At the prices for nylon yarn and nylon staple fibre, it is estimated that nylon turnover may soon account for 25 per cent of Du Pont's gross sales. It is possible that the disproportionate aspect of this rapid development is a major influence behind the Du Pont Corporation's willingness to license nylon to another chemical organisation.

Plastics No Cure-all

THE belief is commonly held in the popular press that plastics constitute a universal answer to shortages caused by stockpiling or rearmament in the steel and other industries. This is far from the case, as articles in THE CHEMICAL AGE have frequently pointed out. Plastics, more than any other synthetic product, demand raw materials, and it is these last that are the very ones which are themselves purified products from other raw materials,

in short supply all round. Some plastics, such as phenol-formaldehyde resins and others do, it is true, use indigenous materials for their manufacture, but the demand for phenol far exceeds the supply, and benzene—used for synthetic phenol and styrene manufacture—is also short. The cresols are as well, due to greatly increased demand and the fact that low quality coal has to be used to give the crude oils from which they have to be distilled. Most other plastics use imported materials. Celluiostic plastics depend on cotton linters imported from America, and thermosetting moulding powders require wood flour and pulp as fillers, materials very hard to obtain from the Scandinavian countries at the moment. Acetone, a vital solvent as well as a substance used in acrylic plastics, is made from imported isopropyl alcohol, and although this and ethylene, obtained from imported molasses, will shortly be in greater production in this country due to a new I.C.I. cracking plant, this plant itself needs another imported raw material, oil. Also, it is obvious that plastics cannot replace things like steel. Apart from the fact that the production of plastics, weight for weight, was about one hundredth that of steel in 1950, plastics have their own valuable properties and they cannot be expected to deputise for such a fundamental material as steel. All in all, the plastics industry is *not* the universal aunt for all our raw material shortages. Plastics are *not* made from air and water, although some day perhaps they may be, and if we look closely at the problem, we find them just as beset by supply shortages as every other industry in Britain to-day.

U.S. Research Efforts

INTERESTING figures about the scope and activities of various American companies' research departments have been given recently by the Department of Industrial Engineering of Columbia University, which took advantage of the presence during a conference of a group of eminent directors, to ask them to give details of the research programmes of the 40-odd companies they represented. These companies, the investigation revealed, with total assets ranging from one to a thousand million dollars, spent a total of about 20 million dollars on research in 1950, employing about 7,000 people all told, with a ratio of professional to non-professional employees of about 0.7. In more than half the companies, the top research executive was a vice-president (very occasionally the president), who had four or less persons reporting to him. Almost half were represented directly on the board of directors, and a strong majority enjoyed the services of a research advisory committee, which usually included representatives of the president's office and sales and production departments.

Projects Undertaken

OTHER information in the questionnaire was that nearly all the research groups were situated near a large city, with 33 near a large university. The mean working area in the research buildings was about 35,000 sq. ft., and only seven of the structures were more than ten years old. The average research budget was about $500.000 on an annual fixed sum basis, which represented 2.2 per cent of total sales with 125 per cent of direct labour added as an overhead. The projects reported were about evenly split between long- (over one year) and short-term programmes, and the firms averaged about 12 patent applications each per year. Almost all the laboratories employed research consultants, and about 70 per cent have contracted work out to universities within the past five years. However, less than half have ever used a private research foundation. These figures, published by *Industrial and Engineering Chemistry*, cannot be considered wholly typical, but they do reflect several interesting facts about research in the United States. No similar figures are available, unfortunately, in this country, the only fact extractable from official bodies being the total sum of money spent on research by industry in 1946. At the risk of appearing bureaucratic, however, might it not be instructive for some enterprising person to attempt to gather some information about research in this country? After all, industrial research is, amongst many other things, a fair measure of a country's progress.

Sir Harold Hartley Elected President

Institution of Chemical Engineers Holds Annual Meeting

THE Institution of Chemical Engineers held its twenty-ninth annual corporate meeting on Friday morning 18 May, followed by the annual dinner in the evening, at the May Fair Hotel, London. The occasion marked the conclusion of two year's of presidency by Professor D. M. Newitt, M.C., F.R.S., and towards the end of the formal proceedings at the dinner he invested his successor, Sir Harold Hartley, with the presidential jewel.

The Council's report for the year ended December, 1950, was presented by the Hon. Secretary, Mr. L. O. Newton.

It showed a continued growth of membership at a normal and healthy rate. The increase in all grades during the year was 175, bringing the total to 2,513.

On education, reference was made to the draft report of the National Advisory Council for Education in Industry and Commerce on 'The Future Development of Higher Technological Education.' Taking advantage of the statement by the Minister of Education that he would welcome and consider comments, the institution emphasised the main points made in an earlier constructive criticism, in which distinction was drawn between primary technologies, such as chemical engineering, which are concerned with a wide variety of manufacturing processes, and secondary technologies, such as leather technology, which are applied in a restricted field. The opinion was expressed that, in general, education in the primary technologies should be a function of the universities, while the development of higher technological education in technical colleges should be concerned more with provision for training in the secondary technologies in selected colleges.

Requests for Recognition

Requests for recognition by the institution for chemical engineering courses were received from several colleges. The council has recognised for five years the post-graduate diploma in chemical engineering obtained at King's College, London, by full-time study for one year as exempting from all the institution's associate-membership examinations. In respect of Battersea Polytechnic, extension of recognition has been granted for a further five years to the one-year diploma course in chemical engineering, and holders of the college diploma are exempted from some of the papers of the associate-membership examination. Similar exemption is granted to candidates who have successfully completed both the four-year course and the following one-year course in chemical engineering at the Polish University College; and in addition, as a temporary measure, candidates are permitted to submit the diploma thesis to determine whether exemption from the other papers in the examination will be granted.

Document Drafted

As the result of the efforts to secure the establishment of Higher National Certificates in Chemical Engineering, a document has been drafted complementary to the Institution's 'Scheme for a Degree Course in Chemical Engineering', and setting out in detail the views of the council on the education of chemical engineers by part-time evening study from Ordinary National Certificate level.

Advice has been given on the establishment of chemical engineering courses in the College of Technology, Bristol, and in the Melbourne Technical College, Australia. At the request of the Yorkshire Council for Further Education, a report of a sub-committee of that council on chemical engineering courses was considered and comments made. Advice was given to the Headmasters' Employment Committee, Ministry of Labour and National Service, on the content of a statement on the education and training of chemical engineers.

With regard to the associate-membership examination, the Council recorded sincere appreciation of the outstanding services rendered by Mr. H. Griffiths to the board of examiners; following his relinquishment of the chairmanship, Mr. G. U. Hopton was appointed as his successor.

At the twenty-fifth annual associate-membership examination there were 118 candidates, including one entrant from Iran, one from Australia, twelve from Holland, five

from New Zealand and one from Trinidad; 77 candidates satisfied the examiners.

In regard to the library, the council wishes to encourage the use of the library postal loan service by members resident outside the London area.

The North-Western Branch of the Institution continues to flourish; its fifth annual meeting was held in Manchester in February, 1950. During 1950 the Midland branch was formed, and Professor Newitt addressed the inaugural meeting in October.

The council again recorded with gratitude the services rendered by the members of the South African Committee, which included the assessment of applications for membership from candidates resident in South Africa. An advisory panel was constituted in India during the year; it will advise the council on matters relating to the education of Indian chemical engineers and election to membership. An Australian advisory committee was also set up, providing a channel through which views may be exchanged on various matters relating to education and to the professional interests of chemical engineers in Australia. The council looks forward with confidence to a period of development there of the objects of the institution through the assistance of the new committee.

Report Presented

The report of the Chemical Engineering Research Committee, appointed by the Advisory Council of the DSIR set up as a result of representations made on behalf of the institution, was presented to the advisory council by Mr. H. W. Cremer (past president), the chairman of the committee, during the latter part of 1950.

The late Mrs. M. W. Ure, widow of Prof. S. G. M. Ure, former member of council and hon. editor for the institution, has left the residue of her estate to the institution upon trust for the foundation of a post-graduate scholarship in chemical engineering.

At the invitation of the council, Mr. C. S. Robinson has accepted the office of hon. registrar, succeeding Mr. H. Talbot, whose long and faithful service to the institution for so many years was acknowledged.

The report referred to the appointment of Dr. J. B. Brennan, general secretary, who assumed duties in April, 1950, and the council expressed appreciation of the efficient and untiring work of the staff during an extremely difficult year.

The meeting sent a message of sympathy to Mr. Mackie, the assistant secretary, who was away ill, and expressed hope for his speedy recovery.

The accounts and balance sheet were presented by the hon. treasurer, Mr. F. A. Greene.

Professor M. B. Donald, who seconded the president's proposal that the report and accounts be adopted, said he could not help feeling that the report would prove a vintage one.

Dr. F. A. Freeth, chairman of the publications committee, announced that, beginning in the summer of this year, the Transactions would be issued in parts. The 1951 Transactions would be in three parts, and later they will be issued quarterly. It is expected to publish about 20 papers a year in the future, compared with 13 or 14 per year in the past.

The election of hon. officers and members of council was announced as follows:—

President: Sir Harold Hartley.
Vice-Presidents: Mr. W. A. Damon, Dr. F. A. Freeth, Mr. R. Edgeworth Johnstone, Prof. E. C. R. Spooner.
Hon. Secretary: Mr. L. O. Newton.
Hon. Treasurer: Mr. F. A. Greene.
Members of Council: Mr. J. C. Farrant, Mr. W. R. D. Manning, Mr. A. S. White, Dr. W. L. Wood.
Assoc. Member of Council: Mr. E. Woollatt.

Medals awarded by the council during 1950 were presented as follows:—

Osborne Reynolds Medal: to Professor F. H. Garner, for his valuable services to the institution, particularly in connection with the formation of the Midlands branch.

Moulton Medal: to Mr. H. Verschoor (Assoc.-Member), for his paper on 'Some Aspects of the Motion of a Swarm of Gas Bubbles Rising Through a Vertical Liquid Column.'

Junior Moulton Medal: to Mr. D. C. Freshwater (Graduate) for his paper on 'Thermal Economy in Distillation.'

Mr. H. W. Cremer (past president), proposing the thanks of the Institution to Professor Newitt for his great service as president during the past two years, said he had combined the highest academic distinction with marked ability in the conduct of the institution's business affairs, and withal, his

work had been carried out with great kindness. For those things the members owed him a great debt of gratitude.

The vote of thanks was seconded by Sir Harold Hartley and was warmly accorded.

In his response, Professor Newitt returned his thanks to the hon. officers, past presidents and Council for their very great support.

Following the meeting, the president delivered his address, but this has not yet been released for publication.

The gathering at dinner included Viscount and Viscountess Falmouth, His Excellency Dr. A. L. Geyer (High Commissioner for South Africa) and Mrs. Geyer, Sir Frederick and Lady Handley Page, Sir Roderic and Lady Hill, and Dr. G. Roche Lynch.

Sir Frederick Handley Page, C.B.E. (chairman of council, City and Guilds of London Institute) proposed the toast of the Institution of Chemical Engineers. He entertained his hearers with his humour, commenting on the results of the combination, by the chemical engineer, of the art of the chemist with the genius of the engineer, and came to discuss the question of technological education and training, with which he is so closely concerned.

Highest Quality Needed

The aspect which interested him particularly in connection with chemical engineers, and indeed, in regard to all engineers in this country, he said, was that we must have the very highest quality of people if we were to achieve success and get right to the top in this competitive world of industry. We had to ensure that the highest possible training was given to everyone according to their natural qualities and gifts, and that the country would derive the greatest value for what was given to them in their training and upbringing. He referred to the proposals made by the Ministry of Education with regard to technology, a most controversial subject. One of the most interesting things which had come about as the result of the recent report of the National Advisory Committee was that everybody had been stimulated to disagree with everybody else; that was natural and was a good thing; complete unanimity would be reached only in Heaven. We had all to address ourselves to making some contribution towards better education and better training in the interests of our great industrial nation and Empire.

The pleasure of proposing the toast of the Institution was made all the greater because he was associating with it the name of its president, Professor Newitt, who was a Professor of the City and Guilds of London Institute College at South Kensington. It was an extraordinarily good thing that in the City and Guilds College, part of the Imperial College, there was a department dealing with chemical engineering. The City and Guilds Institute was founded to make available the results of research work and the scientific discoveries of the people dealing with basic science. He was very thankful that that was still being done in the right way; and it was very pleasing that a man such as Professor Newitt should be president of the institution, that he was giving it real inspiration.

Vivid Personality

Professor Newitt, in his response, said Sir Frederick had reminded him that he had the privilege of belonging to a college in which he (Sir Frederick) took a very close and personal interest, and it was not surprising that the repercussions of his rather vivid personality were not without their effect on the academic tranquillity of the college.

A disturbing thing about education today, he continued, was that there was so very much more to teach than was the case a hundred years ago, and those who were responsible for drawing up syllabuses were constantly having to prune at one end and add at the other; and, such was human nature, they always seemed to add a little more than they had pruned off. As a result, the students tended to suffer from an overburdening of their brains with facts. It seemed quite clear that we had to find some new way of teaching, in order to keep people up-to-date without the overwhelming need for memorising increasing numbers of facts. It might be a good thing to scrap the existing university syllabuses and to construct new ones. The basic operations of the chemical engineer were the basic operations which were common to all industry and which it was very necessary that we should understand. In education we wanted the qualities of initiation, of enterprise and of good judgment; those things were so very important. Possibly, when we had a little more leisure, Sir Frederick might collaborate in an experiment of that kind.

Referring to the work being done to foster the interests of the institution's members

overseas, the president said that Mr. Hugh Griffiths, a past-president, had just returned from a very extensive tour in India, where he had visited educational institutions and industrial centres; as a result the institution had now its advisory committee in India, performing a very useful service in helping members in that country. Mr. J. A. Reavell, a past-president, had made contact with members in South Africa. In that country there was a large body of young chemical engineers, many of them members of the institution, who could be counted upon to assist most materially the industrial development of South Africa.

New Branch Inaugurated

Professor Newitt voiced his pleasure at having inaugurated the new branch of the institution in the Midlands. Professor Garner was chairman of that section, and was also the head of the very flourishing school of chemical engineering in Birmingham.

After a tribute to the graduates' and students' section, which had conducted its affairs in a manner which augured very well for the institution in the future, the president urged that industry had a great responsibility for the way in which it brought on the young men when first they left college, for unless they were given a certain amount of encouragement and opportunity they would not have a chance to develop and make good. One was glad that in most cases that seemed to be recognised and that industry did a very great deal to supplement the college training.

The toast to the guests was proposed by Dr. F. A. Freeth, O.B.E., F.R.S.; and Sir Roderic Hill, K.C.B., M.C., A.F.C. (Rector of the Imperial College of Science and Technology) responded. He wished the institution good fortune in the future and the continuance of the magnificent tradition it had always served.

The ceremony of investing the new president was performed by Professor Newitt, who paid tribute to Sir Harold Hartley's academic and industrial achievements. His wise counsel was always at the disposal of his friends, and by electing him the institution had made a great acquisition.

Sir Harold expressed his gratitude for the confidence reposed in him. During the last fifty years, he said, he had watched developments closely; he had been thrown into chemical engineering in odd ways, sometimes very much off the deep end, and as a result he had the most profound conviction of the great significance of chemical engineering in the industrial future of this country. It was, after all, one of the four primary technologies and was finding such an extraordinarily wide application in the secondary technologies, for which the public had to be so thankful. Sometimes he felt that the chemical engineers had been much too modest; he must be almost the first broadcaster on chemical engineering, and he had always been told what he must not say. The result of that modesty had been that the public had not quite understood how much they owed to chemical engineering.

Expressing to Professor Newitt the institution's gratitude and admiration for his devoted and distinguished service during his term of office as president, Sir Harold said he had served during two difficult and critical years and the institution was particularly fortunate to have had a man of such statesmanlike outlook, courage and determination. He had brought to his office the distinction of a great investigator, whose work had done so much to enrich the science of chemical engineering over a very wide field; in that work he had shown a highly scientific quality, originality and beauty of technique and great judgment in the choice of the subjects he had handled. He was also a great teacher, and the development of the flourishing school of chemical engineering at Imperial College owed much to his devotion to his pupils.

Atomic Research Projects

Latest announcements by the U.S. Atomic Energy Commission show that the non-military phases of nuclear energy continue to occupy much of the effort of American atomic scientists. The AEC discloses that it has awarded 13 new unclassified research contracts to scientists in the fields of biology and medicine, chemistry and physics. In addition, 10 contracts have been renewed, making the total up to 398, a figure which includes 234 in biology and medicine. Typical subjects under study include the mechanism of protection against radiation; low latitude cosmic ray studies; pathological effects of radio isotopes of calcium and strontium on bone and soft tissue; and modification of the cyclotron. A 12-month course of specialised training in nuclear engineering for men in industry has started.

Instruments for Chemical Plant

Part I—Thermometry and Pyrometry

THE development in design and manufacture of industrial instruments during recent years has been vigorous, especially the transformation of certain laboratory gadgets into reliable robust plant instruments for chemical processing. In the following article (which is to be published in several instalments) some modern industrial instruments will be described which are gradually finding their way into daily practical use. The examples shown have been chosen at random, and are of only one type, selected from several available makes. The grouping has been made according to the nature of the measured factor, or of the controlled process variable. More information is available from the literature indicated in the bibliography at the end of the final instalment.

In the development of modern temperature measuring instruments the trend is towards more responsive instruments. The wider use of electronic valves for the magnification of the electric measuring impulse from thermocouples has resulted in very responsive thermometric instruments. As an example, the following types seem worth while describing in some detail.

The patented Cambridge Quick-Acting Recorder has been developed as a very sensitive instrument for recording rapidly changing values of electric resistance or voltage. For example, the instrument may be calibrated in terms of temperature, derived from a potentiometer circuit, or from a resistance bridge. Used as a ratiometer, a double beam infra-red spectrometric value can be measured when used in the field of infra-red spectroscopy. Another high-temperature instrument, having electronic amplification of the impulse current from a thermocouple, say, in an oven, is made by Messrs. Kelvin & Hughes, Ltd. The makers of this electronic controller claim accuracy and sensitivity of control, due to the one-valve oscillator, which eliminates the chopper bar of a potentiometer. Its operation is as follows:—

The variable to be controlled is detected by an appropriate primary element (thermocouple or resistance bulb) which causes a sensitive galvanometer to move over a

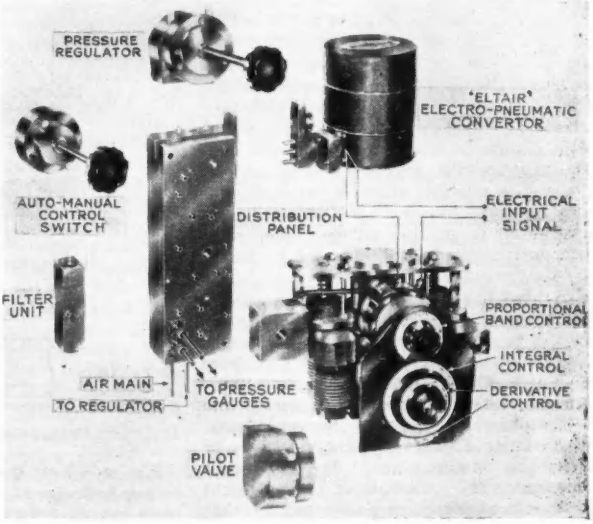


Fig. 1.—Plug-in unit and other parts of the new Trimode electro-pneumatic controller, using electro-pneumatic control mechanism (Courtesy, Elliott Brothers (London) Ltd.)

calibrated scale. A metal vane attached to the indicator pointer moves freely between two coils which are positioned to any selected control point by the control-setting knob. These two coils form part of an oscillatory electronic detecting circuit so arranged that when the metal vane passes between the two coils and reaches a critical point, oscillation ceases. The change in current then actuates a relay which can be connected to operate a regulating device. An imperceptible movement of the indicating pointer about the control point is sufficient to cause positive and instantaneous operation of external apparatus thereby achieving extremely fine control.

Although primarily designed for the control of temperature in furnace work, this instrument can be applied to the control of any variable capable of indication by a moving coil instrument.

The 'Servograph'

Another recently developed high-temperature measuring instrument is portable and can be used in any detecting circuit which provides enough energy to operate the equivalent indicating meter. The instrument, called the 'Servograph," uses an electronic relay circuit, which is precise and needs no adjustment. A servo-motorised mechanism operates the moving part, but the printer of the usual move is replaced by a small light vane which acts as one plate of a variable condenser. Another vane moves in the same arc as the meter-operated vane, and the two are maintained at a constant spacing. The motor-operated pen arm eliminates inaccuracies inevitable with ordinary recorder pens and friction, and the light vane principle allows rapid changes of the measured factor. By connecting the instrument to suitable thermocouples, accurate and long-term stable service is claimed by the makers.

A remarkable step forward in the use of an electronic plug-in unit has been made in the development of a novel instrument, known as the Elliottrol Trimode Controller (Fig. 1). The instrument uses an electric impulse, which is, however, converted into a pneumatically acting power-impulse, which latter actuates diaphragm valves or pneumatic motors, etc. The instrument operates on the force-balance principle, and is capable of exercising 3-term control, that is, proportional, integral, or second derivative (reset-rate).

A novel feature of this controller, which can be used for temperature and for other process variables, is that the control housing with electronic mechanism may be located remotely from the measuring unit with which it is associated. The Elliottrol consists of self-contained sub-units which can be combined in different assemblies. All time settings (integral or re-set time, second derivative or rate time, etc.) are generated in a closed hydraulic system, thus eliminating air leak adjustments. Direct-set calibration dials enable correct settings for all control factors for proportional, integral and derivative mode of control.

The controller can also be used for a pneumatic impulse signal from the detecting control element, thus operating solely on compressed air, with a pneumatic proportionator fitted instead of the electronic unit. Another important feature is a hand-operated switch for auto or manual operation, plugged into the pneumatic distribution panel, so that the controller can easily be switched from automatic to manual control.

In the field of high temperature pyrometry, the development of quick-reading optical pyrometers has filled the need for temperature measurement of very high radiation temperature of quickly moving heated materials.

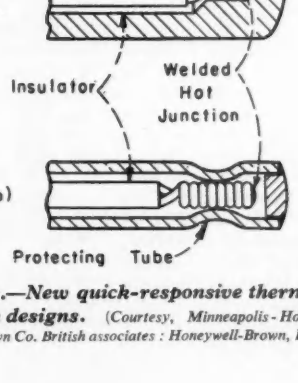


Fig. 2.—New quick-responsive thermocouple designs. *(Courtesy, Minneapolis-Honeywell-Brown Co. British associates : Honeywell-Brown, Ltd.)*

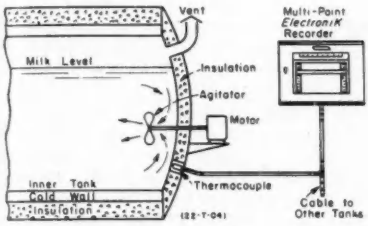


Fig. 3.—Skin-mounted thermocouple to tank and multi-point temperature recorder *(Courtesy, Brown Instrument Co., Philadelphia. British associates: Honeywell Brown, Ltd.)*

One of the most common pieces of process equipment in the chemical industry is the open, agitator-equipped process kettle or vat. For instantaneous accurate temperature measurement, a combination of an electronic recorder-controller with a modern quick-acting thermocouple having the bar tip exposed gives good results. In the U.S.A., thermocouples are sometimes actually mounted on the agitator blade. Various other recent developments have been made in producing quick response to temperature variations. Fig. 2 illustrates two methods. Thermocouple (a) is mounted in a well which has a special recess in the tip to allow better contact. Thermocouple (b) is mounted in a very light protecting tubing. The edges of the tube are rolled inward to bring them into intimate contact with the thermocouple.

Another newly developed method of achieving immediate response without having to immerse the hot junction of a thermocouple into the liquid is shown in Fig. 3. This layout has been developed for use with milk storage tanks, but can be very useful for chemical vessels, where immersion of the temperature detecting element is undesirable. The thermocouple is welded to the outside of the inner wall of the tank, thus entirely eliminating the usual removable bulb and mounting. Location in the end wall also eliminates false temperature reading due to the influence of coolant being circulated in the cylindrical jacket. The multi-point instrument measures the temperature in several tanks (up to 16), and produces clear records, if desired.

In instrumentation of chemical plants, or for heat treatment operations, the use of multi-point indicators or recorders has become recently more widespread. By wiring a number of thermocouples of the modern quick-responsive type to a multi-point indicator (Fig. 4), the plant operator or chemical engineer can at any time check several temperatures by simply turning a selector switch on a centrally located multiple thermometer or pyrometer. Where continuous temperature records are required, multi-pen thermometers with coloured record curves on circular charts or strip charts are available, enabling the chemical engineer to compare at a glance co-ordinated temperature values.

It should be noted that electrical industrial resistance thermometers have also been developed to a high degree of reliability and accuracy, and are becoming more widely used in recent years. Modern resistance thermometers allow very small increments of temperature to be indicated or recorded, an instrument quality which makes them very attractive to the chemical engineer. The use of modern balancing mechanism in place of galvanometer parts simplifies the instrument design, and makes it more convenient for industrial use. A very recent development of electric proportioning temperature controls meets the demand for low cost control outfit of drying rooms or apparatus, etc., where favourable controllability of the process makes the use of proportional mode of control possible. Fig. 5 shows the gradually operated motorised control valve associated with the new Teddington controller. A proportional torque unit (lever motor) is also available for operation of air dampers, etc.

Fig. 4.—Cambridge null point indicator for temperature of gas *(Courtesy, Cambridge Instrument Co., Ltd.)*

The operating torque of the proportioning

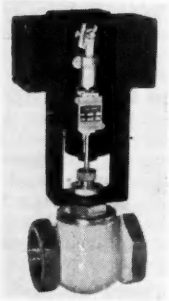


Fig. 5.—Motorised control valve for proportional control (*Courtesy, British Thermostats, Ltd.*)

unit is provided by a reversible, totally enclosed motor, coupled to a very high ratio gearbox mounted in a robust cast main frame. In the Model Z.A. Valve as shown, a sliding crank mechanism is attached to the final drive from the gearbox, to provide a readily adjustable vertical movement to suit the size of valve fitted. This sliding crank mechanism is fitted with an indicating pointer to indicate valve travel between fully opened and fully closed positions.

Vertical movement operating the valve is transmitted through a double acting overload spring assembly, to ensure tight shut off when the valve is closed without causing damage to the gearbox or motor. A balancing potentiometer slider and a limit switch breaker are fitted to the other end of the final drive shaft.

A step down transformer for the low voltage signal circuit and the motor reversing condenser are housed in a compartment on one side of the cast main frame, and the reversing relay and terminal block are housed in a similar compartment on the reverse side. The gearbox, limit switch and potentiometer housing, relay and transformer compartments have easily removable cast inspection covers. These covers have machined joint faces to provide a tight seal against the damp and corrosive action of a surrounding atmosphere.

By reference to the wiring layout (Fig. 6), it will be seen that a change in temperature at the sensitive phial of controller 'A' causes the potentiometer slider to move and thereby upsets electrical equilibrium. If greater electrical potential appears across one of the relay operating coils, the unbalanced magnetic force thus created causes a moving armature to close a pair of contacts. On closing, these contacts complete the circuit to one field of the electric motor,

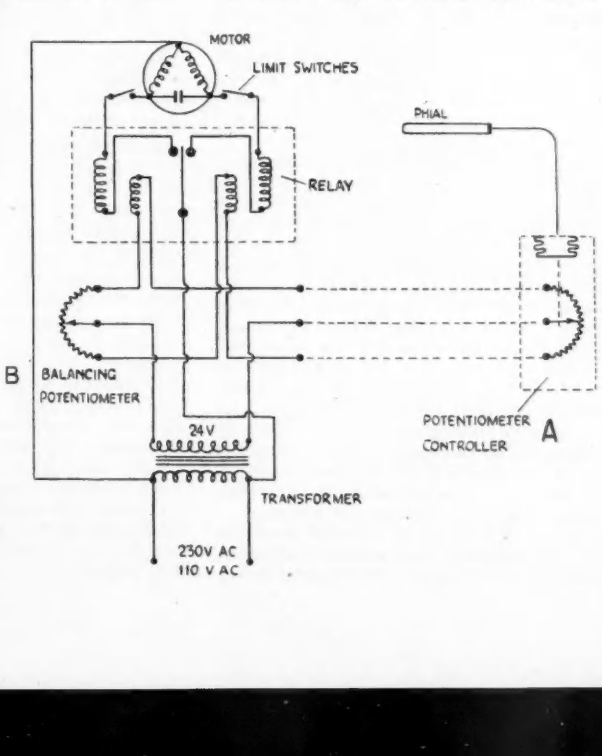


Fig. 6.—Wiring diagram for motorised valve of Teddington controller

which is thus energised to drive the valve in the required direction to off-set the initial cause of the change in temperature.

While the valve spindle is moving, the main driving shaft of the gearbox is rotating, and with it the slider of balancing potentiometer 'B'. The rotation of this slider causes electrical equilibrium to the relay circuit to be restored, which in turn restores the position of the armature, thus opening the contacts and stopping the motor. In the event of a change in temperature in the opposite direction the unbalanced voltage from the potentiometers actuates the balancing relay to close another pair of contacts, energising the motor to run in the opposite direction until electrical equilibrium is again restored.

As an additional safeguard against damage which might be caused by the interruption of the signal circuit, limit switches (opened by the action of an insulated projection attached to the final shaft) are arranged to come into operation if the final shaft makes an angular movement in excess of the 180° normally employed. Provision has also been made for the manual operation of the valve spindle which might be necessary in the event of supply failure. This equipment is suitable for operation on A.C. supply only. Standard units would operate on either 110 or 230 volts, 50 cycles, single phase supply. Special windings for use on other A.C. voltages will be supplied to special order only.

Evershed Process Controller

An interesting newly developed process controller using electronic amplification can be used for simpler or more elaborate control problems in chemical processing because it makes possible either proportional, or integral, or derivative modes of control. This is the new Evershed process controller.

The controller is operated in conjunction with the standard range of transmitters associated with the Evershed Electronic Repeater and throughout the system, which is current controlled. The signal is a small D.C. current having a maximum of 30 milliamperes. This signal is originated by a transmitter unit which contains the measuring element and passes to the controller *via* recording, indicating and integrating instruments. From the controller it passes to the final control element, in most cases a control valve where the electrical signal is converted into a valve position by means of the Evershed Electro-Pneumatic Relay (Fig. 7).

This relay embodies a mechanical feedback from the valve stem, ensuring that the

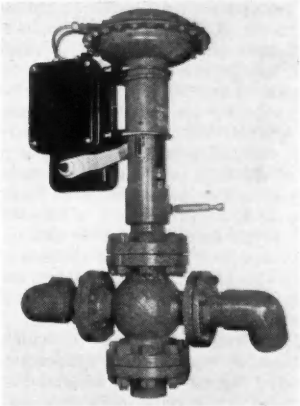


Fig. 7.—Diaphragm control valve with valve positioner
(Courtesy, Evershed & Vignoles, Ltd.)

valve position is truly proportional to the D.C. signal received (valve positioner). Adjustments are provided in the form of pointer knobs moving over calibrated scales under a hinged glazed cover, which is secured by two screws to render unauthorised access more difficult. Provision is made for transferring from auto to hand control and the valve position is indicated by a miniature instrument in the front of the controller.

Operation of the equipment is independent of variations of supply voltage and frequency or of the resistance of the signal lines. The components of the controller are mounted on trays fitted with multi-pin plugs, enabling them to be rapidly serviced by replacement, as all similar units of the equipment are interchangeable. All the adjustments to this controller are made by means of wire-wound potentiometers and are thus accurately repeatable. The circuits of the various control functions are so designed as to be independent of each other.

Proportional control in which the valve movement is proportional directly to the measured quantity, is achieved by repeating the signal received from the measuring

element by means of a photoelectric repeater incorporating a differential shunt, permitting adjustment of the proportional band. A unit whose output is a controllable datum signal in the form of a small D.C. current is also provided, enabling the desired valve to be set up in the repeater unit. The proportional band adjustment is calibrated from 2 to 600 per cent.

Integral and Derivative Control functions are supplied by one valve whose anode current serves the integral and derivative terms. Integral control in which the movement of the final controlled element is proportional to the integral of error with respect to time, is provided by a photoelectric bridge which detects the error and charges a large capacitor in the grid cathode circuit of the valve at a rate which is proportional to that error. The integral time control is calibrated 2-50 minutes.

The derivative function, in which the movement of the valve is proportional to the rate of change of the measured quantity, is supplied by a static differentiating R.C. circuit operated by the current in the measuring circuit. The output voltage of this circuit is added to that of the capacitor described above, in the grid cathode circuit of the valve. The derivative control is calibrated from 0-20 minutes derivative time.

This survey of recent developments in instrumentation has dealt with a few novel temperature measuring and control instruments of interest to the chemical engineer. Another article will describe new instruments for composition analysis, electrical conductivity, *p*H and spectroscopic measurement.

(To be continued)

World Sulphur Plan

Committee Makes Nine Recommendations

THE ten-nation committee at the International Materials Conference being held at Washington, D.C., has proposed that sulphur be placed on a world allocation basis for the balance of 1951, and has recommended nine measures for conserving and extending the supply of the element. Details of the allocation plan have not yet been revealed, but the committee have reported that they have to deal with a sulphur deficit of probably over 1,000,000 tons in 1951. It is intended at present, it is believed, to allocate sulphur to the ten member-nations on the committee and non-member nations of the Western world. This committee is one of seven set up by 24 Western nations on the subject. Its proposals for economy are as follows:—

1. Regeneration of sulphuric acid used in the manufacture of aviation fuels in countries with large-scale 'Avgas' manufacturing;
2. Recovery of sulphuric acid used for pickling steel and manufacturing titanium dioxide;
3. Reduction of acid used in some manufacturing processes by utilisation of calcium sulphate, a by-product of triple superphosphate;
4. In nations where soil and climatic conditions are suitable, use of finely ground rock phosphate as a soil dressing;
5. Doubling the utility of sulphuric acid by using it in manufacturing potassium or sodium sulphate, thus obtaining hydrochloric acid, which in turn can be used to manufacture dicalcium phosphate;
6. Increased research to develop inexpensive processes for recovery of carbon bisulphide and sodium sulphate;
7. Savings of large amounts of sulphur in paper and pulp factories which use chemically prepared salt cake, by employing the electrofilter recovery process;
8. In areas where cheap power is available, manufacture of concentrated superphosphate by use of phosphoric acid rather than sulphuric acid. Phosphoric acid can be made by an electric furnace process.
9. Substitution of nitric acid for sulphuric in the manufacture of fertilisers.

Glassware at Festival

Among exhibits in the Dome of Discovery at the Festival of Britain is a 26-foot absorption tower for reclaiming concentrated hydrochloric acid.

Manufactured by Quickfit and Quartz, Ltd., of Stone, Staffs., the tower produces 2,000 lbs. of 30 per cent acid every hour. Such towers enable the recovery of hydrochloric acid which would otherwise be wasted.

Other Quickfit and Quartz Festival of Britain exhibits include examples of laboratory glassware in the Lion and Unicorn Pavilion, notably a magnetically controlled reflux divider, a coil condenser and a Stadler all-glass water still.

Pest Control in Germany

Schrader's Work on Insecticides

SINCE the war various British teams of investigators have interviewed Dr. Gerhard Schrader, the German chemist whose important series of researches on organic fluorine and phosphorus compounds resulted, *inter alia*, in the discovery of a number of potent insecticides. At the request of one of the teams Dr. Schrader prepared a fuller account of this work, including preparative details and his ideas on the relationship between chemical constitution and toxicity in this series.

Due to the destruction or inaccessibility of his records and notes there are certain gaps, especially in the insecticidal data and the preparative methods. It has nevertheless been possible to piece together a coherent account of Schrader's research on insecticides. A summary of this work is included in BIOS Report No. 32 (HMSO), 'Pest Control in Germany during the period 1939-1945', by R. P. Tew, of the Agricultural Research Council.

Extensive Research

In 1934, I. G. Farbenindustrie initiated an extensive programme of research directed towards the development of new types of synthetic insecticides, for use mainly as nicotine substitutes. Dr. Schrader at Leverkusen was given charge of the chemical synthetical aspects. Initially, attention was given to the preparaton of organic fluorine compounds, since at that time research in the inorganic field had resulted in the cheaper production of both elemental fluorine and fluorine compounds.

The pronounced insecticidal effects of certain alkyl carboxyl fluorides had already been established by Dr. Kükenthal in the Biologische Institut at Leverkusen. These were, however, too lachrymatory and sternutatory for general use. The research led to an investigation of the insecticidal action of organofluorine compounds containing nitrogen (carbamyl fluorides), sulphur (sulphonyl fluorides), and phosphorus (phosphoryl fluorides, etc.). From the investigation of the latter classes a general study of organophosphorus compounds arose.

Stimulus of inorganic research, at Leverkusen, on the preparation of elementary fluorine and of compounds of fluorine with chlorine and bromine, led to the preparation, from ethylene chloro- and bromofluorides, of 'mixed' halogenated ethanes (*i.e.*, α-chloro and α-bromo-β-fluoroethanes). In these compounds it was found that whereas the fluorine substituent is firmly held, the chlorine, and more especially the bromine, atom is easily replaced. Substitution of bromine by an amino group gave methylamino, dimethylamino- and diethylamino-fluoroethanes (volatile liquids forming hydrochlorides). The preparation of these compounds has been patented, although the insecticidal activity was very low.

In 1933-35 Dr. Ufer, of Ludwigshafen, developed and patented two methods for the production of fluoroethyl alcohol. Schrader, who in work with fluoroethyl acetate had detected a pronounced contact insecticidal action, decided to investigate systematically the activity of the derivatives of fluoroethyl alcohol. He concentrated at first upon the development of a rapid laboratory method for preparing the alcohol. He found that tetraethanol-ammonium hydroxide could be converted to the fluoride by aqueous hydrofluoric acid and the pure alcohol distilled off from this compound at 150-170°C., the residue consisting of triethanolamine. The neatness of this method lies in the fact that tetraethanol-ammonium hydroxide may be regenerated from triethanolamine, water and ethylene oxide. It is, therefore, virtually a synthesis from ethylene oxide and hydrofluoric acid.

Schrader prepared a number of esters from hydroxy compounds of fluoroethyl alcohols. The most active was di-(β-fluoroethyl) sulphite, $SO(O.CH_2CH_2F)_2$, from thionyl chloride and fluoroethyl alcohol. This compound was found to be of the same order of activity against aphids as nicotine, and represented a definite advance in the development of a synthetic nicotine substitute. Even so, contact effect was slow.

The methylals $CH_2\langle^{O.CH_2CH_2F}_{O.CH_2CH_2F}$

and $CH_2\langle^{O.CH_2CH_2O.CH_2CH_2F}_{O.CH_2CH_2O.CH_2CH_2F}$

were prepared from β-fluoroethyl alcohol and β-fluoroethyl-β-hyroxyethyl alcohol respectively by condensation with paraldehyde in the presence of a trace of concentrated sulphuric acid. Both compounds applied as contact sprays at 0.1 per cent gave 100 per cent control of aphids and control at higher concentrations of woolly aphis and scale insects. Interest in the corresponding chlorine compounds centres upon claims for their chemo-therapeutic action in plants. Schrader refers to experiments in which the compounds were applied in 0.1 per cent aqueous solution to the leaf surface of young maize plants and to the soil in which they were growing. Plants so treated were rendered toxic to biting and suctorial insects and also to rabbits fed upon the foliage.

Persistence Indicated

These experiments indicated the persistence of the agent within the plant for some weeks after application. The methylal $CH_2(O.CH_2CH_2O.CH_2CH_2F)_2$ was also considered as a rodenticide and its value for this purpose has been established. The fumigant activity of *bis*-β-(fluoroethoxy) methane was also established by tests against the grain weevil. No evidence of phytotoxicity is quoted, apart from a passing reference to a 'slight harvest deficiency' in treated grapes, but the toxic hazard to humans and animals from consuming contaminated fruit or plant produce is fully recognised. Schrader is enthusiastic, however, and recommends research to assess the value of these agents for plant chemotherapy and to develop manufacturing processes.

A number of urethanes of fluoroethyl alcohols were prepared by the standard method *via* the chloroformic ester. Reports on the activity of these compounds are conflicting, but Schrader states that those from β-fluoroethyl-β-hydroxyethyl ether possess insecticidal action to aphids. They are also extremely effective rodenticides when impregnated on to wheat grains.

Toxicity to warm-blooded animals of fluoroacetic acid was stated to be of the same order as that of the alcohol. The use of its salts as rodenticides has been patented, but no contact insecticidal action has been established.

In the course of Schrader's investigations the preparation of aliphatic and aromatic sulphonyl chlorides, by reaction between the appropriate sulphonyl chloride and concentrated alkali fluoride in aqueous solution at 90-100°C., was undertaken. Methane sulphonyl fluoride, $CH_3.SO_2F$, was found to possess a high degree of fumigant activity against a number of insect species. The fumigant was subjected to a number of trials under the name 'Vaporising Medium No. 1908'. At Bonn, for instance, tests were made using one, two and five per cent aqueous solutions of the compound.

Volumes of all these solutions which contained amounts of methane sulphonyl fluoride equivalent to an aerial concentration of the order of 0.02 g/m³. gace 100 per cent kill of black fly on broad beans. Schrader also refers to the successful use of this compound against ants and suggests trials of its anti-termite activity. He stresses the advantage of easy and cheap preparation, non-inflammability, and the stability of its aqueous solutions, but recognises that a great drawback to its employment against the insect pests of stored grain is the ease with which it sorbs on to nearly all surfaces. Fumigated wheat, for example, although effectively disinfested, remains toxic to mammals for an extended period.

Valuable Data Provided

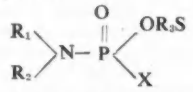
Schrader provides valuable data on the preparation of methane sulphonyl fluoride, and stresses the importance of separating phosphorus oxychloride and methane sulphonyl chloride, the products of the initial reaction between sodium methyl sulphate, phosphorus pentachloride and chlorine, before reaction with aqueous potassium fluoride. Otherwise variable yields result on account of catalysis by the phosphorus oxychloride of the hydrolysis of methane sulphonyl chloride.

Fluorosulphonates were prepared by heating the diazofluoro sulphonates in turn prepared by reaction between diazonium salts and concentrated aqueous ammonium fluorosulphonate. Compounds prepared from aniline were found to possess low insecticidal activity, but their use as wood preservatives has been patented in Germany.

Schrader turned his attention to an investigation of the biological activity of the organo-phosphorus compounds when he decided that the organic sulphonyl fluorides had virtually exhausted the possible variations in the linkage.

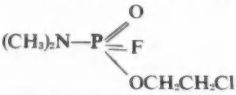
As a starting material for the preparation

of a range of derivatives of alkylamino phosphine oxides, the reactive chloro compound $(CH_3)_2N.PO.Cl_2$ was selected. This compound was shown by Kükenthal to be extremely active as a contact aphicide and with little or no vapour effect. Other compounds of the following general type were prepared, and their use as 'pest eradication' agents protected in German patent No. 155/39:—



where R_1, R_2 and R_3 are alkyl groups and X is an inorganic or organic acid residue.

Investigation of compounds in which X was propionate, butyrate, chloroacetate, chloride and cyanate, all of which apparently secured practically 100 per cent control of aphids by contact effect, is mentioned by Schrader but he expresses doubts as to their applicability as insecticides on account of their high mammalian toxicity. The view is expressed that the β chloroethyl ester



is worthy of further investigation as, in addition to insecticidal activity, it is water-stable, not of high volatility, and of low toxicity to mammals.

The insecticidal activity, presumably due mainly to fumigant effect, of the difluoro compound $(CH_3)_2N.POF_2$, is reported as being of the same order as that of dimethylamino sulphonyl fluoride. From this organo-phosphorus compound, however, may be produced other fluoro phosphine oxides of higher insecticidal activity and interest. *Bis*-dimethylamino fluoro phosphine oxide, for instance, is a colourless, water-soluble liquid found to be stable to hydrolysis and of high toxicity as a contact insecticide.

Interest, however, centres upon its possession, in common with certain other phosphorus compounds and the methylals of β-fluoroethyl alcohol, of 'plant chemotherapeutic action'. Several derivatives of phosphonous anhydride and two methylals were also shown to be very effective contact aphicides, and Kükenthal demonstrated their chemotherapeutic effect by the application of 0.05 per cent aqueous solutions to the roots of *cineraria* infested with aphids.

Schrader related systemic activity of this class of compound to the possession of N—P and P = O linkages, but in a later interrogation stated that, on a broader basis, correlation between chemical constitution and systemic activity was not possible at the present stage of knowledge.

For the preparation of dialkyl fluorophosphonates Schrader rejected the method developed by Lange and Krüger, in which the silver salt of fluorophosphonic acid is reacted with alkyl iodide. He submits methods of preparation in which the most important starting materials are those of the general formula $(RO)_2POCl$, $ROPOCl_2$ and, for thio analogues, $ROPSCl_2$. He also describes the preparation of diethyl fluorophosphonate from *Bladan*, in which this compound in benzene solution is reacted at 70°C., and for 12 hours with potassium hydrogen fluoride.

Recommended Uses

Use of this compound is recommended as a contact insecticide for the control of aphids, woolly aphis, scale insects, bugs and caterpillars. In addition to its contact insecticidal effects, data are quoted which reveal the marked fumigant effect of this compound on houseflies, aphis and bedbugs. On the basis of the data obtained (including the effectiveness of this compound at 0.01 per cent in the control of grain weevil in empty warehouses), Schrader recommends its widespread use as a general insecticide. He expresses the view, which does not receive support from United Kingdom research, that at effective concentrations toxicity to man is negligible.

Following the observation of well-developed contact toxicity in the case of tetraethylpyrophosphate, Schrader investigated the preparation and activity of a number of alkyl polyphosphates. By reaction between triethyl phosphate and phosphorus oxychloride, at a temperature not exceeding 140°C., a 95 per cent yield of a condensation product, which Schrader named *Bladan*, was obtained. The preparation was protected by German Patent No. 720,570. Subsequently a method of production involving direct reaction between phosphorus oxychloride and absolute alcohol was developed. Attempts to 'scale up' the second method by trebling

the quantities of reagents used in preliminary laboratory preparations resulted in the production of less pure *Bladan*, low in ethoxyl content and correspondingly high in phosphorus content.

Method Too Sensitive

From experiments Schrader concluded that this method of preparation was rather too sensitive for satisfactory application on the plant scale. The implication from reports of his interrogation, however, is that this method, which was developed on account of shortage in Germany of triethyl phosphate, is with greater experience and careful control producing satisfactory yields of *Bladan* of adequate quality. Presumably on account of the shortage of phosphorus pentoxide Schrader was, at the time of his interrogation (December, 1947) unfamiliar with the methods using this compound which have been developed in the United Kingdom.

Bladan was found to compare favourably with *Venetan*, a commercial preparation based upon nicotine, in so far as complete control of aphids was given by both formulations at concentrations corresponding approximately to 0.05 per cent active principle.

In an attempt to evolve a lime stable insecticide material of the same order of toxicity as *Bladan*, Schrader developed tetraethyldithiophosphate $(C_2H_5O)_2.PS—O—PS.(OC_2H_5)_2$, and the mixed compound $(C_2H_5O)_2.PS—O—PO.(OC_2H_5)_2$, both these compounds being water-stable and of pronounced insecticidal activity (100 per cent control of aphids claimed with 0.005 per cent solution). Schrader considered that in the tetraethylthiophosphate were combined those properties required of a good nicotine substitute. He was of opinion that effort should be directed towards the development of a suitable technical process for the production of this compound.

Schrader's observation of the relation between insecticidal activity and the chemical structure led to the study of a range of substituted phosphoric esters, the object being the development of a satisfactory agent for the control of the extremely widespread Colorado beetle. Among the compounds tested were three which showed greater promise than others, namely, diethyl-*p*-nitrophenyl phosphate, ethyl (diethyl phosphoryl) acetoacetate, and diethyl-*p*-nitrophenyl thiophosphate. The first two of these esters were found to give better control of Colorado beetle at a concentration of *ca.* 0.025 per cent and a rate of application of 1,000 litres per hectare than the conventionally employed lead arsenate (concentration 0.1 per cent). Moreover, the first-mentioned, at least, was found to possess ovicidal action towards this pest. In addition, well-developed activity towards a wider range of insects was established.

Diethyl-*p*-nitrophenyl thiophosphate, on the other hand, was found to be almost without effect on Colorado beetle at all stages, although of equal effect against aphids and suctorial insects. Its possession of lime stability and its lower toxicity to mammals recommend its employment as a 'lime stable *Bladan*'. The survey comments on this further evidence of the view of German toxologists that the limit of mammalian toxicity for safe employment in plant protection corresponds to a median lethal dose of the order of 5 mg/kg.

There is general agreement among most of the investigators that the methods employed for the assessment of the biological activity of the various compounds were not satisfactorily quantitative, the emphasis being mainly upon establishing the presence or absence of toxicity. This lack of quantitative data makes difficult a fair assessment of the value of many of the agents developed and suggests the desirability of further study in many instances.

This position has, however, already been remedied to some extent by post-war research in Allied countries, of particular interest being the confirmation by several workers of the insecticidal activity of many of the organo-phosphorus compounds developed by Schrader and of the 'systemic' insecticidal activity of some. The authors of the survey are of opinion that Schrader and his co-workers have opened up a very promising new field for development.

New Aluminium Source

A tract of land in Jamaica believed to be the world's largest undeveloped source of aluminium has been acquired by the Reynolds Metals Company. Mr. Walter L. Rice, president of the Reynolds Mining Corporation, said the area contained enough bauxite to supply the United States with aluminium for many years. Reynolds will mine the area with the aid of a £4,500,000 Government loan from the Economic Co-operation Administration.

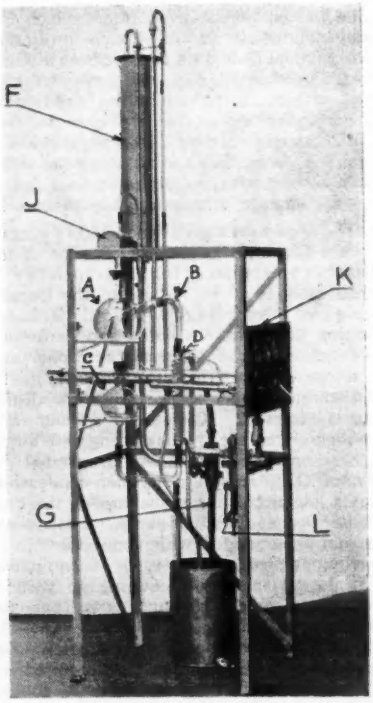
New Laboratory Evaporator

Vacuum Concentration at Low Temperatures

THE evaporation at low temperature of relatively large volumes of aqueous or other extracts often presents difficulty. If of biological origin, frothing may be troublesome; as the liquid becomes concentrated and viscous, heat transfer is reduced and local over-heating may result, leading to severe bumping and destruction of thermolabile substances. In a recent issue of the New Zealand Journal of Science and Technology, Mr. N. W. Vere-Jones, of the DSIR, Wellington, describes a simple but, the author claims, effective apparatus for overcoming many of these difficulties. It may be constructed from standard laboratory equipment and can be made to evaporate as much as 20 litres per hour.

The accompanying diagram illustrates the apparatus. The evaporator, A, is made from an ordinary flask (that illustrated is of five-litre capacity), into which is inserted a vapour pipe, B. This may conveniently be done by welding a 'Quickfit' socket to the wall of the flask and inserting therein a 'Quickfit' plug carrying a tube. To the bottom of A is welded a glass tube connected to another flask, C, which acts as a reservoir for the concentrate—the size of C should be determined by the volume of liquid to be concentrated and the concentration required. When the final volume of concentrate is small, C may be omitted and the tube from the bottom of A connected directly to the heating tube, or calandria, D. When C is required, a tube is welded to its bottom and connects with D. An alternative is to take this tube from the side of the neck of C, which then becomes a 'salt box', a convenient arrangement when much solid matter is thrown out of solution during the evaporation. D consists of a steam-jacketed tube; for many purposes a silver tube is most convenient, though stainless steel, silver-plated copper, or glass are practically alternatives. The heating tube connects directly with the vapour pipe entering A. A 'tee', for the introduction of the feed, is inserted between C and D. The neck of A connects with a condenser and vacuum pump. Some form of splash head is advisable between evaporator and condenser to separate entrained liquid from the vapour.

When the apparatus is under vacuum, liquid to be concentrated is sucked into the apparatus until it reaches a convenient height in A, usually one or two inches above its bottom outlet. Steam is admitted to the jacket of the calandria and causes rapid boiling in D. A slug of liquid and vapour is ejected at high velocity against the wall of A. This action very effectively breaks up any foam in A, the effectiveness of the action depending on the level of liquid in A and, particularly, on the distance between the end of the vapour pipe and the



wall of the flask; 5-10 mm. is generally satisfactory. Liquids otherwise impossible to distill under vacuum because of excessive foaming have been successfully concentrated in this type of apparatus. Feed is continuously admitted to maintain the liquid level in A.

With a silver-plated copper heating tube an apparent overall coefficient of heat transfer of 750 B.Th.U./hr./sq. ft./°F. temperature difference can be expected. From this figure the size of heater appropriate for a required evaporation may be calculated. The one illustrated is 15 inches long and 1 inch in external diameter, and will evaporate three gallons per hour at a temperature of 35°C. For high rates of heat transfer, the tube should have a highly polished surface; in spite of its lower conductivity, glass may be found to have a higher overall coefficient than a rough metal tube owing to the high film coefficients of the latter. The heat transfer figure quoted is higher than that normally found in modern commercial evaporators which employ natural circulation, though lower than the maximal figures which have been attained with forced circulation. Not only will high heat transfer rates reduce the duration of the evaporation but they will give rise to a rapid pumping action in the apparatus and thus reduce the time during which the liquid is in contact with the heated surface and so restrict damage to thermolabile substances.

The apparatus was designed and fabricated by the Chemical Engineering Section of the Dominion Laboratory for the evaporation of grass extracts at the request of the Department of Agriculture's Animal Research Station, Ruakura. A spray and perforated plate condenser, F, is used; as vapour and cooling water are in direct contact, this is efficient but impermissible when the distillate is required. Condensed vapour and cooling water are discharged against atmospheric pressure by a water-operated jet pump, G. Air and other non-condensible gases are ejected from the top of the condenser by another jet pump. J is an entrainment separator with connection to a vacuum gauge. This type of equipment has the advantage of requiring no vacuum pump or other moving parts, but the mechanical efficiency is low. For the evaporator described, approximately 800 gallons of water per hour are required for the condenser and ejectors, with cooling water at 65°F. If a surface condenser had been used, this alone, if a reasonable size, would have required about 300 gallons of water per hour at 65°F., to evaporate an aqueous extract at a temperature under 100°F. For lower temperatures of evaporation, special condensing and vacuum-producing apparatus would be necessary. The control panel, K, has valves and gauges for control and measurement of vacuum, steam and water pressures to the condenser and to the ejectors.

In laboratories where steam is not available as a service, a tin can will form an adequate boiler, as steam above atmospheric pressure is not required. The pressure of service steam would require reduction to below 5 lb. per sq. in. gauge (L in Fig.), or back-surging in the apparatus will probably occur. This surging is also affected by the height of the liquid level in the apparatus relative to the top of the heating tube; increasing this height reduces the tendency to surge, but only at the expense of an elevation of the boiling point due to the resulting static head. With a vacuum of 29 in. of mercury, this rise in boiling point will be about 18°F. for a static head of 12 in.

For small rates of evaporation (*e.g.*, of the order of one litre per hour), silver tubes of 5 mm. bore and a few inches in length will be found satisfactory, with a corresponding reduction in size of the other parts of the apparatus.

The description of this evaporator in the New Zealand Journal of Science and Technology is given with appreciation to Mr. F. J. T. Grigg, Director of the Dominion Laboratory, for his interest and permission to publish the note.

Sulphur Barges on Fire

Fires broke out on two barges laden with sulphur at London docks on Thursday, 17 May. The first occurred on a barge carrying 50 tons of sulphur at Free Trade wharf, Stepney, and was brought under control in about half-an-hour. The second at Surrey Commercial dock was more serious, 150 tons of sulphur being involved. Six pumps had to be used, and firemen equipped with oxygen masks had difficulty in preventing the fire from spreading. Cause of the outbreaks is being investigated by police and senior fire brigade officers.

Synthetic Lacquer Linings

Process That Can be Applied on Site

PROTECTION of tanks and containers against corrosion and metallic contamination has long been a problem not only to the chemical and allied trades, but also to the food and drink industries where cleanliness and sterility are essential.

Various alternatives to stainless steel, metallic coatings, and glass or enamelled vessels have been tried in recent years. Lithcote as a tank lining was first used in America for the protection of vessels used in the brewing and dairy industries.

A much wider range of applications soon became evident, however, and in 1938, Newton Chambers & Co., Ltd., accepted a sole licence for Lithcote in the British Isles. During the war it was tried out and used extensively as an alternative to special alloy metals which were in short supply.

Considerable research and development have taken place since then, and this phenol-formaldehyde synthetic lacquer is now made in several grades, each of which has been specifically designed for and tested to meet particular conditions of service.

The article to be Lithcoted is first shot-blasted under a pressure of 40-60 lb. giving it a matt, chemically-clear surface to which the lacquer readily adheres. It then undergoes a low temperature bake, up to 200°F., which may be repeated 3-5 times according to the particular characteristics of the metal being treated. In the final bake, the temperature is raised gradually to 320°F., and may last from 24-36 hours, according to the mass of the metal.

A New Improvement

A new improvement in the method of treating metal containers has eliminated the possibility of any part remaining bare. The Lithcote is thin, yet has a great deal of flexibility, so that it can be put on before the metal is seam-folded.

Vessels lined with Lithcote may be used for acids, solvents, brines, alcohol, fats, syrups and oils over a wide range of temperatures. The smooth, tough, non-porous surface is easily cleaned and does not chip, star, crack or separate from the parent metal vessel.

Initial cost of treating new equipment is recovered, it is claimed, by saving in cleansing and maintenance, while the life of existing plant can be lengthened by several years after it has been re-claimed and re-vitalised by lining with Lithcote.

A Great Advantage

One great advantage of Lithcote linings is that they may be applied *in situ* which enables much equipment to be re-claimed which would otherwise be unserviceable. Tanks are lined and then lagged with blankets to keep in the heat while baked with a portable furnace. Temperature factors are all important and thermocouples are installed.

The present increasing shortage of steel has brought the wide range of Lithcote applications into renewed prominence. As it is based on phenolic resins it is quite harmless, and even though it may be accidentally damaged it will not have any adverse effect on the product with which it comes in contact.

During recent years Lithcote linings have made great progress and have solved many problems in the chemical industries. Among articles recently treated were an impressor for Courtaulds; trays for the I.C.I. dyestuffs division; water containers for armoured fighting vehicles; dough bowls for bakeries; and trays for steam ovens which are now-a-days being Lithcoted where they were formerly galvanised.

Three grades of Lithcote are now available. 'N' type coating is for cold acid conditions, while 'E' type has been designed specifically to resist hot neutral solutions, organic solvents and alkaline detergents.

A more recent edition to the range of grades is the 'P' type, which gives a somewhat less brilliant gloss, an advantage in certain applications. The lacquer is 'filled' with a special material which enhances its general quality. In colour it is yellowish buff. It is more resistant to abrasion than the other two, and it has been found generally better when applied to tanks and equipment which have been so badly corroded as to make the decision to scrap almost unavoidable.

Polyvinyl Alcohol Finds New Uses

by A SPECIAL CORRESPONDENT

POLYVINYL alcohol made by the hydrolysis of polyvinyl acetate or by an ester interchange process can be produced in a number of different forms suitable for specific applications. Although the greatest interest is still taken in the completely hydrolysed alcohol which is impervious to all water-insoluble solvents and gases, although soluble in hot water, the development of new partially hydrolysed alcohols has largely increased the usefulness of this thermoplastic material. Probably the greatest advantage of the partially hydrolysed resin is its ability to accept plasticisers which are able to improve its mouldability and heat-sealing properties. By the modification of polyvinyl alcohol with thermosetting resins capable of achieving cross-linking, it is possible to produce a form that is not dissolved by hot water, and can, therefore, be employed for uses requiring a reasonable degree of water-resistance.

The Most Important Uses

The most important uses now found for polyvinyl alcohol can be tabulated as follows:—

(1) Industrial hose required to carry aromatic and aliphatic hydrocarbons, chlorinated hydrocarbons, animal and vegetable oils.

(2) Printing, coating and draw rollers possessing high solvent-, oil- and abrasion-resistance.

(3) Diaphragms, gaskets, and packings for use with petroleum derivatives, hydraulic oils, synthetic insecticides, Freons, paints, etc.

(4) Textile finishes and sizes. The latter are recommended for use with elastic yarns where it is necessary to provide a size that will not crack or split off the yarn. In Germany during the war, polyvinyl alcohol was used as a textile size for Perlon U which has an elongation at break of 15-20 per cent. Polyvinyl alcohol is suitable for textile finishing following treatment with urea-formaldehyde or melamine-formaldehyde resins. The action of the alcohol is to reduce the swelling of such fibres as rayon and also to improve the handle of the finished fabric.

(5) As an ingredient of fast-drying printing inks, polyvinyl alcohol achieves a useful purpose by improving penetration and acting as an efficient binding agent for the pigment. The presence of the alcohol is claimed to be particularly valuable in printing inks used on plastic surfaces. The alcohol is also of value in ceramic binders, distempers, and similar products.

(6) Polyvinyl-alcohol-based adhesives can be re-moistened and are of special value in packaging. In Germany, a 3-5 per cent solution of Vinarol 50 (polyvinyl alcohol) to which was added a small amount of formaldehyde, was used as an adhesive in offices, for packaging food products and in leatherwork for sticking fabric to leather as in the interiors of bags and cases.

(7) Dispersions made with polyvinyl alcohol have a high resistance to break-down and the alcohol is, therefore, of value in the preparation of polyvinyl acetate dispersions and similar polymeric preparations. In the production of wax emulsions, cosmetics, pharmaceutical products, etc., polyvinyl alcohol is also useful.

(8) Protective films not required to be water-resistant can be made from polyvinyl alcohol. These films are tough, unaffected by oils and solvents, and they can easily be peeled off the surface when their protective action is no longer required.

Used for Driving Belts

It will, of course, be remembered that during the war years in Germany considerable use was made of polyvinyl alcohol for making driving belts. For this purpose an alcohol with a low saponification value and low ash content was employed. Broadly, the process comprised making a strong solution of polyvinyl alcohol in water, adding to it various polyhydric alcohols as a plasticiser, spreading this solution in thin layers one on top of the other on an endless belt, partly drying the band between each layer so that a belt of the desired thickness is built up, drying, pickling in phosphoric acid and ageing.

Before specifying polyvinyl alcohol for any purpose, it is important to consider carefully the most suitable grade for the purpose.

Fuel Supplies Improve in Western Germany

Synthetic Rubber and Plastics Projects

COAL shortages which drastically reduced production in the early months of this year have now been mainly overcome and most German chemical manufacturers state that output has recently increased. Raw material shortages which are still acutely felt in other German industries do not appear to affect chemical production in general, though factories dependent on imported commodities are beginning to suffer from the difficulties already being experienced in other European countries.

Owing to the restrictive financial policy introduced by the Federal Government to balance foreign trade and payments, the home demand for finished goods has declined, but the chemical industry benefits from increased purchases for stocks by consumers afraid of further price advances and the universal expansion of export demand. As a result, the foreign business is assuming increasingly large proportions in most sections of the German chemical industry.

Restrictions imposed by the Federal Government on investment credit threaten to upset the plans prepared by the coal-oil industry in anticipation of the removal—announced in April—of the Allied ban on the production of certain chemical products of strategic importance. Fischer-Tropsch interests have let it be known that a capital sum of over Dm. 50 million would be required to convert the six F-T plants in the Ruhr area to the latest synthetic processes.

New Catalysts Employed

A process operating with much higher pressures than the original F-T process has been developed by Ruhrchemie and Lurgi. This employs new catalysts which are claimed to yield 50 tons of primary products a day in one contact furnace and allow more economical use of water-gas. Motor spirit with an octane number of 76 can be produced, but in fact it is not intended to concentrate on the production of motor spirit and diesel oil when the German F-T plants are put into operation again; one-third of the projected output of 150,000-180,000 tons, or an even higher proportion, is to consist of lubricants, hard paraffin and Kogasin fractions.

On behalf of Ruhrchemie AG it has been stated that part of the existing F-T capacity could be put into commission fairly soon if the Federal Government gives the necessary modernisation work a high priority. This, however, is unlikely to happen. A large part of the apparatus required for the South African Fischer-Tropsch plant, which will employ a variant of the Ruhrchemie-Lurgi process, on the other hand, is to be made by West German plant manufacturers.

Prospects More Promising

Prospects for the resumption of the synthetic rubber production are considerably more promising. Chemische Werke Huels has applied to the Federal authorities for permission to resume production in two stages. At first the production of butadiene is to be 500 tons a month. Most of this would be used for making buna S3, while a small part of the output would be sent to the Bayer works at Leverkusen where it is to be worked up into Perbunan. Investments to the amount of Dm. 2.5 million will be needed for this first part of the scheme which is to be completed in five months. Later, production is to be raised to 1,800 tons a month, but capital investments of Dm. 15 million are said to be required for this as it is proposed to employ an improved U.S. process, based partly on German research work, which would ease the fuel and power problem.

While it is believed that the Federal Government will agree to the first-stage, approval of the second part of the project will be more difficult to secure even though the company argues that the currency savings from synthetic rubber production should, with the world price of rubber anywhere near its present level, amply justify the investments required.

German plastics production is, according to a memorandum submitted to the Federal Government by the interests concerned, expected to rise this year by 22-25 per cent above the 1950 figure of 58,000-60,000 tons. At present the plastics producing industry is using about 50 per cent of its capacity, while fabricators use theirs at an average rate of 36-38 per cent.

A catalytic high-pressure refining process is being used for benzole in the Ruhr.

Publications & Announcements

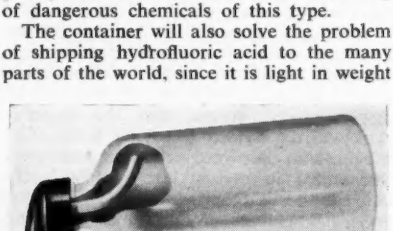
THE Quasi-Arc Co., Ltd., have recently issued a 12-page brochure dealing with the 'Unionmelt' process of automatic submerged arc welding, for which they are sole licensees in the United Kingdom. This high quality method of welding consists of the deposition of molten metal from a continuous wire electrode, which is fed automatically into the melt at a rate determined by a voltage control unit, on to the parent metal, through a blanket of finely divided slag-forming material. This material, known as 'Unionmelt Powder' is an electrically fused granulated product which gives, claim the makers, perfect distribution of components throughout the entire mass, and enables high currents and fast speeds to be used, the slag acting as a cleanser for the melt and a shield from the atmosphere.

* * *

HYDROFLUORIC acid—which eats its way through glass—has always been a particularly difficult and dangerous product to handle: now that danger is a thing of the past—thanks to a new, unbreakable, drip-proof, lightweight plastic container, which is a new addition to the Poly-Tainer range.

Fitted with a patented pouring device, the new container is said to be completely drip-proof and leak-proof, as well as air-tight and moisture proof, and should completely eliminate accidents in the handling of dangerous chemicals of this type.

The container will also solve the problem of shipping hydrofluoric acid to the many parts of the world, since it is light in weight

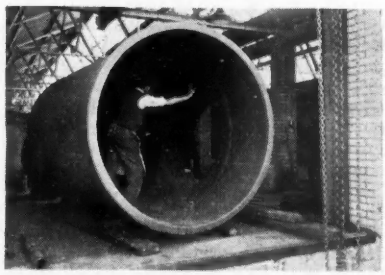


and unbreakable—which eliminates the risk of spoilage or corrosion of adjacent materials.

The container is made in two sizes—16 oz. and 80 oz.: but a whole range of Poly-Tainer bottles and jars resistant to most chemicals are made in sizes from 1-80 oz.

RUBBER sheeting was employed extensively at Fisons' new factory at Immingham for the protection of plant against acid and acid fumes. Among the items lined with rubber in the phosphoric acid plant by the Andre Rubber Company, Surbiton, were the reaction vessels for the digestion of phosphate rock with dilute sulphuric acid; steel and wood launders for the circulation of reacted pulp; storage tanks for phosphoric acid; the chimneys for the phosphoric acid plant to take away fumes from the reaction vessels and also chimneys for the triple superphosphate plant.

Most of the work was carried out on site but transportable equipment was lined at the Andre rubber factory.



Part of a chimney stack, supplied by Stockdale Engineering Ltd., being lined with rubber at the Andre factory for Fisons, Immingham

* * *

TRETOL, Ltd., protective coating and pigment manufacturers, have issued the April number of their house journal 'Building Topics.' This quarterly magazine covers the field of building protection and maintenance, and is available free of charge. The April number contains an article on the selection of protective coatings for chemical fume resistance, by a U.S. corrosion specialist, and one on mildew growths on building surfaces. Also included is an article on chemical treatments used in metal surface preparation, and one on concrete surface finishes. A technical inquiry bureau deals concisely with corrosion problems brought up by readers.

The Chemist's Bookshelf

PLASTICS, SCIENTIFIC AND TECHNOLOGICAL. Third Edition. H. R. Fleck. Temple Press, Ltd. London. 1951. Pp. 414. 40s.

It might seem an almost impossible task to survey the whole of the voluminous literature dealing with plastics and synthetic resins in a textbook of moderate size. This task has been achieved, on the whole successfully, in this very reasonably priced book. This is the third edition to be published, the first having appeared in 1944, and the subject matter has been thoroughly revised and brought up-to-date. In order to make room for some of this new material the author has found it necessary to limit the scope of his survey by omitting the sections dealing with synthetic elastomers which appeared in earlier editions. While the necessity for this is appreciated it must be seen as a loss, and it is hoped that the author may find it possible to write a companion volume dealing in a similar fashion with the deleted subject.

In a reference book of this type it is important that the indexing should be of at least as high an order of completeness as the original coverage of the book itself. In some cases this is not so and, for example, the subject of 'polyvinyl ethers' does not appear under the headings of acetylene, alcohols, ethers, vinyl ethers, or polyvinyl ethers, but only under the name of the discoverer of their preparation from acetylene, Reppe. This is an assumption of knowledge on the part of the searcher which may not be justified. The arrangement of information within the chemical section tended to be rather confused and a more rigid scheme based upon chemical structure might have been adhered to. In addition the section upon German war-time achievements was so condensed that it was difficult to follow, while mention of the synthetic plasma substitute polyvinyl pyrrolidone was omitted. It is suggested that the cracking of ethylene dichloride to vinyl chloride and hydrogen chloride over activated carbon is a possible commercial source of polyvinyl chloride. Even if a process of this type could compete with the route from acetylene it is almost certain that the halogen-catalysed process would be used. These are on the whole, however, small points, and the book with its tables of properties will be useful to students, chemists and technicians.—J.R.M.

WERKSTOFFZERSTORUNG UND SCHUTZSCHICHTBILDUNG IM WASSERFACH. By L. W. Haase. Verlag Chemie G.m.b.H., Weinheim/Bergstrasse. 1951. Pp. 218 with 102 Fig. DM. 15.80.

The book presents in a short and clear manner the scientific fundamentals of corrosion and surface protection, both indispensable for the practical man and of great importance to industry and domestic water supply. It deals comprehensively with the various injuries to some materials by water. The identification, prevention and examination of injuries to different materials is not only a subject of chemical or metallurgical science, but it also requires some knowledge and experiences of the border sciences, such as bacteriology, microbiology, colloid chemistry, electrochemistry and geology to avoid wrong conclusions. The book is divided into five chapters dealing with chemical and electrochemical actions causing material destruction, often through additional currents, with attacks through cold and warm water and through the soils. Soft waters more than hard are likely to attack iron and lead and hardness is not known to be injurious to water for drinking purposes (potable water); in fact the presence of bicarbonate prevents its corrosion action.

The subject of corrosion and surface protection is treated in the book in such detailed manner that it will not only serve the water chemist, underground engineer, sanitary technician, etc., but will also be helpful to contractors of tube fittings, steam boiler and electric and water plants. It concludes with a comprehensive bibliography and subject index, which enables the reader to study the subject in detail and to see the connections of cause and effect.—F.N.

HOME

Chemists' Farm Tour

The first farm tour, to take place in the West Country, has been arranged by the Agricultural and Food Groups of the Society of Chemical Industry for mid-September. The tour will include visits to places in Herefordshire, Gloucestershire and Worcestershire, where fruit and vegetables will be seen growing and being processed in various ways. The final day will be spent at Long Ashton Research Station. Applications (with booking fee £1 1s.) should reach the secretary not later than 30 May.

The Fertiliser Society

At the fourth annual general meeting of The Fertiliser Society, held at Ipswich on Thursday, 10 May, Mr. E. H. I. Brown was elected president and Dr. E. M. Crowther vice-president.

Dr. G. W. Cooke, Mr. R. P. Libbey and Mr. J. H. Thompson were elected to the council in place of Mr. D. P. Hopkins, Mr. A. E. Sell and Dr. R. Stewart who had retired by rotation.

Electronics Exhibition

The sixth annual Electronics Exhibition, organised by the North-Western branch of the Institution of Electronics, will be held at the Manchester College of Technology from 24-26 July. An extensive programme is planned, including, in addition to the products of the usual exhibitors, a non-commercial section showing exhibits from universities and scientific associations.

Pulsometer—Joseph Evans

The Pulsometer Engineering Company Limited, pumping, refrigerating and filtration plant manufacturers of Reading, have acquired the total share capital of Messrs. Joseph Evans and Sons of Wolverhampton, who have been pump makers since 1810.

Each organisation will continue to operate separately to give old customers the type of service on which they have hitherto depended. In combination, production will be speeded up, efficiency increased and developments kept abreast of all modern requirements, providing jointly a most comprehensive range of reciprocating, centrifugal, turbine, and vacuum pumping plants together with refrigerating and water purification installations.

Sulphur from Coke-Oven Gases

A new method of obtaining sulphur from coke-oven gases has been patented by Audas and Thompson, Ltd., of Eaglescliffe, Stockton-on-Tees. Long-term tests are likely to begin shortly on the process, by which it is hoped to produce up to 60,000 tons of sulphur annually. It is claimed that the new process will almost do away with manual methods now employed at most gas works and will result in the extraction of twice as much benzole. It is also stated to be quicker in operation and to require less space.

International Agricultural Conference

Delegates from 26 countries are expected to attend an agricultural conference organised by Plant Protection, Ltd., to be held at Fernhurst Research Station, near Haslemere, Surrey, next month. Methods will be discussed of checking grop losses due to disease and insect pests and the latest spraying machinery will be demonstrated.

1949-50 Petroleum Consumption

Recently published are the 1949-1950 statistics relating to the consumption and production of petroleum in this country, as compiled by the Petroleum Information Bureau. There are five tables, covering the consumption of petroleum products; the deliveries of motor spirit and gas, diesel and fuel oils; the production of petroleum products and indigenous crude and process oils; and the indigenous materials distributed by the petroleum industry.

Notable trends are the increase in consumption of motor spirit and diesel engine road fuels by 10 per cent from 1949-50 due to the rationing system being discarded after May 1950, and the decrease in aviation spirit consumption over the same period by 11 per cent. Other figures are: gas, diesel and fuel oils burnt in 1950—2,880,000 tons, 9 per cent up on 1949; the same, used for power production—2,456,000 tons, 13 per cent up on 1949; and an increase in home production of nearly 50 per cent on the 1949 total of 6,164,000 tons of petroleum products ex imported, and indigenous crude and process oils (including shale).

• OVERSEAS •

Control of Carbon Black

American exports of furnace carbon black have been placed under quota control. The U.S. Office of International Trade have announced that the quota for the second quarter has been set at 30 million pounds. Channel black is still being licensed to meet requirements of friendly foreign countries without respect to a specific quantitative limitation. The quota is effective for the entire second quarter (1 April to 30 June) and a considerable amount of channel black has already been licensed for export against the quota.

Synthetic Rubber Drum

A new 55-gallon synthetic rubber-fabric drum, suitable for use in the petroleum, liquid chemicals, and other fields, has been developed by the United States Rubber Company. The drums, which can be collapsed after emptying and are returnable and re-usable, are expected to effect large savings in return shipping costs, since more than 2,500 collapsed drums can be shipped in a standard railroad box car that normally holds only 300 rigid drums. The new drum, according to company officials, is suitable for the shipment of oils, greases, fats, acids, paints, emulsions, soaps, dry powders, and a variety of pharmaceutical and industrial chemicals. Made of non-corrosive, non-absorbent material, and highly resistant to weathering, the new drum results from nearly three years' development and testing work by the rubber company.

American Atomic Health

The United States has the impressive figure of 5 per cent of all her scientists and engineers working on atomic energy in various forms, and health precautions have received a great deal of attention. Workers in atomic energy plants may soon be given periodic blood tests to detect excessive doses of radiation, since it has been discovered that irradiated persons often develop double-cored white blood cells instead of the normal single-cored variety. These may easily be detected under the microscope, and the worker can then be temporarily shifted to another job.

Unesco-Brazilian Co-operation

An agreement in which the United Nations Education, Scientific and Cultural Organisation will render technical assistance to Brazil's five-year economic development programme was recently concluded in Paris. Three scientists, specialists in electronics and cosmic ray studies, will be sent by Unesco to work at the Brazilian Centre of Physical Research opened at Rio de Janeiro in 1949. Unesco will also supply up to $5,000 worth of scientific equipment for its mission and make three fellowships available to Brazilian scientists working in these fields.

To Sell Assets

From Canada comes news that shareholders of Standard Chemical Co., Ltd., have unanimously approved the sale of assets (except shares of Dominion Tar and Chemical Co.) to Dominion Tar and Chemical Co., Ltd., for $5,850,000. Additional Dominion Tar shares will be acquired to bring Standard Chemical's total holdings of Dominion Tar shares to 300,000. This is equivalent to two-fifths of a Dominion Tar common share for each of the 50,000 shares of Standard Chemical common stock outstanding. The preferred shares (30,000 5 per cent $100 par shares) will be redeemed and common shareholders will receive two Dominion Tar shares for each five Standard Chemical shares plus cash which is not expected to exceed 50 cents per share.

New Radiation Detector

A new atomic radiation detector that permits direct readings to be taken has been developed in New York by the G.E.C. Called a radiation monitor, this instrument weighs less than a pound, is the size of a quart container, and needs neither valves nor dry-cell batteries. Radiation measurements from the monitor are read simply by noting the position of a pointer as it moves across a scale, the pointer moving in direct proportion to the radiation. During a given time, the distance that the pointer moves indicates the radiation to which the instrument has been exposed. The monitor is used by all who work with or near sources of atomic radiation and is extremely sensitive.

· PERSONAL ·

The General Electric Co., Ltd., has appointed MR. O. W. HUMPHREYS, B.Sc., F.Inst.P., M.I.E.E. director of the research laboratories of the company. Mr. Humphreys has been the manager of the laboratories for the past two years, having been appointed to that position following the death of Sir Clifford Paterson.

Mr. Humphreys is a member of the Councils of the British Electrical and Allied Industries Research Association and of the British Non-Ferrous Metals Research Association. He is closely associated with the work of the Institute of Physics and of the Institution of Electrical Engineers, and has just been elected a manager of the Royal Institution. He serves on various committees of the British Standards Institution and was a member of the Board of Trade Committee of Inquiry into the Organisation and Constitution of the B.S.I. which presented its report last year.

PROFESSOR F. H. GARNER, Dean of the Faculty of Science, Birmingham University, and director of the department of chemical engineering, has been awarded the Redwood Medal by the Institute of Petroleum for 'outstanding contributions to the institute and to the petroleum industry'. He has also been awarded the Osborne Reynolds Medal for 1950, by the Institution of Chemical Engineers.

MR. L. BOWDEN, director of the Cornbrook Chemical Co., Ltd., Stockport, has been elected chairman of the Manchester branch of the Institution of Works Managers for 1951-52.

MR. EDWARD GURR, a director of Edward Gurr, Ltd., manufacturers of biological stains and reagents, recently gave a broadcast to overseas listeners on the short wave entitled 'Meet the Commonwealth'. At the recent BIF Mr. Gurr was presented to the Lord Mayor and Lady Mayoress of London and His Highness Prince Abdul Hajid of Jordan when they visited his firm's stand.

PROFESSOR H. E. WATSON will retire from the Ramsay chair of chemical engineering in University College, London, at the end of the present session. Educated at Marlborough and University College, Prof. Watson had a most distinguished college career. He gained further experience in research in the Universities of Berlin, Geneva and Cambridge, working for a time in the Cavendish Laboratory, Cambridge. In 1911 he was selected to be assistant professor of inorganic and physical chemistry at the Indian Institute of Science, Bangalore, and later was appointed to the chair. On returning to Great Britain in 1934 Prof. Watson was appointed to his present chair.

MR. MAXWELL BRUCE DONALD has been appointed to succeed Prof. Watson. In 1918 Mr. Donald obtained the associateship of the Royal College of Science with a first class in chemistry and was awarded a Yarrow Scholarship for study in the United States. After working at the Massachusetts Institute of Technology he spent three years in Chile investigating problems of nitrate production. In 1931 Mr. Donald was appointed a lecturer, and in 1947 reader in chemical engineering at University College, London. From 1937-49 he was the honorary secretary of the Institution of Chemical Engineers and is now vice-president of the Institution. He is also a member of the council of the Royal Institute of Chemistry and the Chemical Council.

At the annual general meeting of the Institute of Physics held on 16 May, PROF. W. E. CURTIS (Professor of Physics, King's College, University of Durham, Newcastle-upon-Tyne) was re-elected president. DR. J. TOPPING was elected a vice-president and MR. O. W. HUMPHREYS and DR. S. H. PIPER were elected Ordinary Members of the Board. The honorary treasurer, MR. E. R. DAVIES, and the honorary secretary, DR. B. P. DUDDING, were re-elected. DR. A. B. WOOD and MR. C. G. WYNNE join the Board as the new representatives of the Physical Society.

British Chemical Prices

LONDON.—In practically all sections of the general chemicals market active trading conditions have now returned and reports received during the past week indicate a brisk inquiry for shipment. A steady buying interest has been displayed in the potash chemicals and the general run of the soda products, and in most other directions a steady demand has been maintained. Supplies here and there remain tight with spot requirements difficult to place. There has been little alteration in the overall price position of the industrial chemicals. Activity in the coal tar products is more or less limited by the scarcity of current supplies, and with producers well sold forward, new bookings have been few. The export demand for American duty free cresylic acid continues to be on a good scale.

MANCHESTER.—The effect of the Whitsuntide holidays on the Manchester chemical market has been dispersed and a steady demand in many sections has been reported this week. Home users are specifying for steady deliveries of caustic soda and other alkali products under contracts, and there has been a good call for the magnesia and ammonia compounds, as well as for a wide range of other goods. There has been no lack of fresh inquiry in the market on home-trade account, whilst buying for export has been on steady lines. Firm price conditions continue in all sections The tar products generally are active and in few lines are early deliveries obtainable.

GLASGOW.—Demand for the general run of chemicals has been steady but business during the past week has been noticeably quieter. Prices are still firm and it is interesting to note that shortages of certain dyestuffs are being met by supplies from Germany. Italian suppliers have been enjoying a good demand for some pigments, but by and large, prices from the Continent are much too high to arouse any widespread interest. Following a quiet beginning the week overall has been a good one from the export side.

General Chemicals

Acetic Acid.—Per ton : 80% technical, 1 ton, £110 ; 80% pure, 1 ton, £116 ; commercial glacial 1 ton, £129 ; delivered buyers' premises in returnable barrels ; in glass carboys, £7 ; demijohns, £11 extra.

Acetic Anhydride.—Ton lots d/d, £166 per ton.

Acetone.—Small lots : 5 gal. drums, £105 per ton ; 10 gal. drums, £100 per ton. In 40/50 gal. drums less than 1 ton, £85 per ton ; 1 to 9 tons, £84 per ton ; 10 to 50 tons, £83 per ton ; 50 tons and over, £82 per ton.

Alcohol, Industrial Absolute.—50,000 gal. lots, d/d, 4s. 7½d. per proof gallon ; 5000 gal. lots, d/d, 4s. 8½d. per proof gal.

Alcohol, Diacetone.—Small lots : 5 gal. drums, £133 per ton ; 10 gal. drums, £128 per ton. In 40/45 gal. drums : less than 1 ton, £113 per ton ; 1 to 9 tons, £112 per ton ; 10 to 50 tons, £111 per ton ; 50 to 100 tons, £110 per ton ; 100 tons and over, £109 per ton.

Alum.—Loose lump, £17 per ton, f.o.r. MANCHESTER : Ground, £17 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER : £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—2 cwt. non-returnable drums ; 1 ton lots £47 per ton.

Ammonium Chloride. — Grey galvanising, £27 10s. per ton, in casks, ex wharf. Fine white 98%, £21 10s. to £22 10s. per ton. See also Salammoniac.

Ammonium Nitrate.—D/d, £18 to £20 per ton.

Ammonium Persulphate. — MANCHESTER : £5 15s. per cwt. d/d.

Ammonium Phosphate.—Mono- and di-, ton lots, d/d, £88 and £86 10s. per ton.

Antimony Sulphide.—Golden, d/d in 5 cwt. lots as to grade, etc., 2s. 6¼d. to 3s. 4¼d. per lb. Crimson, 3s. 6½d., to 4s. 6½d. per lb.

Arsenic.—Per ton, £44 5s. to £47 5s., ex store.

Barium Carbonate.—Precip., d/d ; 2-ton lots, £30 per ton, bag packing.

Barium Chloride.—£38 to £38 10s. per ton.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £33 5s. per ton d/d ; 2-ton lots, £33 10s. per ton d/d.

Bleaching Powder.—£19 10s. per ton in casks (1 ton lots).

Borax.—Per ton for ton lots, in free 140-lb. bags, carriage paid: Anhydrous, £57 10s. ; in 1-cwt. bags; commercial, granular, £37 ; crystal, £39 10s. ; powder, £40 10s. ; extra fine powder, £41 10s. ; B.P., granular, £46 ; crystal, £48 10s. ; powder, £49 10s. ; extra fine powder £50 10s.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid : Commercial, granular, £66 ; crystal, £73 ; powder, £70 10s. ; extra fine powder, £72 10s. ; B.P., granular, £78 ; crystal, £85 ; powder, £82 10s. ; extra fine powder, £84 10s.

Butyl Acetate BSS.—£263 per ton, in 10-ton lots.

Butyl Alcohol BSS.—£250 per ton, in 10-ton lots.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid £9 12s. 6d. per ton, in 4-ton lots.

Charcoal, Lump.—£25 per ton, ex wharf. Granulated, £30 per ton.

Chlorine, Liquid.—£28 10s. per ton d/d in 16/17-cwt. drums (3-drum lots).

Chrometan.—Crystals, 6d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Per lb., d/d buyers' premises, for 5 cwt. or over, anhydrous, 1s. 9d. plus 10%, other, 1s. 9d. ; 1 to 5 cwt., anhydrous 1s. 9½d. plus 10%, other 1s. 9½d. Higher prices for smaller quantities. All subject to a trade discount of 5%.

Cobalt Oxide.—Black, delivered, 11s. 2d. per lb.

Copper Carbonate.—MANCHESTER : 2s. 4d. per lb.

Copper Chloride.—(63%), d/d, 2s. 8d. per lb.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Nitrate.—(63%), d/d, 2s. 7d. per lb.

Copper Sulphate.—£82 5s. per ton f.o.b., less 2%, in 2-cwt. bags.

Cream of Tartar.—100%, per cwt., about £11 12s. d/d.

Ethyl Acetate.—10 tons and upwards, d/d, £174 per ton.

Formaldehyde.—£33 per ton in casks, according to quantity, d/d.

Formic Acid.—85%, £66 to £67 10s. per ton, carriage paid.

Glycerin.—Chemically pure, double distilled 1,260 s.g. £14 9s. 0d. per cwt.
Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb. ; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb. ; bulk carriage paid.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—27.5% wt. £116 per ton. 35% wt. £146 per ton d/d. Carboys extra and returnable.

Iodine.—Resublimed B.P., 18s. per lb. in cwt. lots.

Iodoform.—22s. per lb.

Iron Sulphate.—F.O.R. works, £3 15s. to £4 5s. per ton. Bags free.

Lactic Acid.—Pale tech., 44 per cent by weight £130 per ton ; dark tech., 44 per cent by by weight £110 per ton ex works ; Usual container terms.

Lead Acetate.—White : £146 10s. per ton.

Lead Carbonate.—Nominal.

Lead Nitrate.—£150 per ton.

Lead, Red.—Basis prices per ton : Genuine dry red lead, £178 10s. ; orange lead, £190 10s. Ground in oil : red, £199 ; orange, £211.

Lead, White.—Basis prices : Dry English, in 8-cwt. casks, £185 per ton. Ground in oil : English, under 2 tons, £201 10s.

Lime Acetate.—Brown, ton lots, d/d, £18 to £20 per ton ; grey, 80-82%, ton lots, d/d, £22 to £25 per ton.

Litharge.—£178 10s. per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £27.

Magnesium Carbonate.—Light, commercial, d/d, £74 5s. ; cwt. lots £82 10s. per ton d/d.

Magnesium Chloride.—Solid (ex wharf), £15 per ton.

Magnesium Oxide.—Light, commercial, d/d, £187 ; cwt. lots £192 10s. per ton d/d.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., lump, 10s. 8d. ; smaller quantities dearer.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methanol.—Pure synthetic, d/d, £28 to £38 per ton.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 4s. 2d. per gal. ; pyridinised 64° O.P. 100 gal., 4s. 4d. per gal.

Nickel Sulphate.—F.o.r. works, 3s. 4d. per lb. (Nominal.)

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—About £146 per ton, packed in 5-cwt. lots, packed in free 5-cwt. casks.

Paraffin Wax.—From £58 10s. to £101 17s. 6d., according to grade for 1-ton lots.

Phosphoric Acid.—Technical (S.G. 1.500), ton lots, carriage paid, £67 per ton ; B.P. (S.G. 1.750), ton lots, carriage paid, 1s. 2½d. per lb.

Potash, Caustic.—Solid, £88 10s. per ton for 1-ton lots ; flake, £105 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate.—Crystals and granular, 10¾d. per lb. ; ground, 11¾d. per lb., for not less than 6 cwt. ; 1-cwt. lots, ¼d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £88 10s. per ton for 1-ton lots, ex store ; hydrated, £81 for 1-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Chloride.—Industrial, 96%, 6-ton lots, £16 10s. per ton.

Potassium Iodide.—B.P., 16s. 2d. per lb. in 28 lb. lots.

Potassium Nitrate.—Small granular crystals, 81s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 7½d. per lb. for 1-cwt. lots ; for 3 cwt. and upwards, 1s. 6½d. per lb. ; technical, £8 3s. per cwt. ; for 5 cwt. lots.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—Dog-tooth crystals, £72 10s. per ton ; medium, £67 10s. per ton ; fine white crystals, £21 10s. to £22 10s. per ton, in casks.

Salicylic Acid.—MANCHESTER : Technical 2s. to 2s. 8d. per lb. d/d.

Soda Ash.—58% ex depôt or d/d, London station, £8 17s. 3d. to £10 14s. 6d. per ton.

Soda, Caustic.—Solid 76/77% ; spot, £18 4s. per ton d/d.

Sodium Acetate.—£70 to £75 per ton d/d.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 9d. per lb. ; anhydrous, 9¼d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite.—Powder, 60/62%, £29 12s. 6d. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2-cwt. free bags.

Sodium Chlorate.—£52 to £57 per ton.

Sodium Cyanide.—100% basis, 8d. to 9d. per lb.

Sodium Fluoride.—D/d, £4 10s. per cwt.

Sodium Hyposulphite.—Pea crystals £23 2s. 6d. a ton ; commercial, 1-ton lots, £21 12s. 6d. per ton carriage paid.

Sodium Iodide.—B.P., 17s. 3d. per lb., in 28 lb. lots.

Sodium Metaphosphate (Calgon).—Flaked, loose in metal drums, £114 ton.

Sodium Metasilicate.—£19 to £19 5s. per ton, d/d U.K. in ton lots.

Sodium Nitrate.—Chilean Industrial, 97-98%, 6-ton lots, d/d station, £23 per ton.

Sodium Nitrite.—£29 12s. 6d. per ton.

Sodium Percarbonate.—12½% available oxygen, £8 4s. per cwt. in 1-cwt. drums.

Sodium Phosphate.—Per ton d/d for ton lots : Di-sodium, crystalline, £34 10s., anhydrous, £73 ; tri-sodium, crystalline, £36 10s., anhydrous, £70.

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Silicofluoride.—Ex store, nominal.

Sodium Sulphate (Glauber Salt).—£8 per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. £6 per ton d/d station in bulk. MANCHESTER : £6 10s. per ton d/d station.

Sodium Sulphide.—Solid, 60/62%, spot. £27 per ton, d/d, in drums ; broken, £27 15s. per ton, d/d, in drums.

Sodium Sulphite.—Anhydrous, £29 10s. per ton ; pea crystals, £20 10s. per ton d/d station in kegs ; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £15 11s. 6d. to £17 16s. 6d. according to fineness.

Tartaric Acid.—Per cwt. : 10 cwt. or more, £14.

Tin Oxide.—1-cwt. lots d/d £25 10s. (Nominal.)

Titanium Oxide.—Comm., ton lots, d/d (56-lb. /112 lb. bags), £122 per ton.

Zinc Oxide.—Maximum price per ton for 2-ton lots, d/d ; white seal, £180 10s. ; green seal, £179 10s. ; red seal, £178.

Zinc Sulphate.—Nominal.

Rubber Chemicals

Antimony Sulphide.—Golden, 2s. 6½d. to 3s. 8d. per lb. Crimson, 3s. 6½d. to 4s. 9½d. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Off colour, ex store. Imported £13 10s per ton. Extra white bleached ex store, £16.

Cadmium Sulphide.—About 20s. per lb.

Carbon Bisulphide.—£65 5s. per ton, according to quality.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£64 10s. per ton.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 1s. 9½d. to 2s. 3d. per lb. ; dark, 1s. 8½d. to 2s. 1½d. per lb.

Lithopone.—30%, £61 per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermillion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, £13 1s. 6d.

Compound Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. Special No. 1, £20 17s. 6d.

"Nitro-Chalk."—£12 9s. 6d. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean agricultural for 6-ton lots d/d nearest station, £19 17s. 6d. per ton. Chilean industrial for 6-ton lots £23.

Coal-Tar Products

Benzol.—Per gal, ex works : 90's, 3s. 3d. ; pure, 3s. 5½d. ; nitration grade, 3s. 7½d.

Carbolic Acid.—Crystals, 1s. 1d. to 1s. 3d. per lb. Crude, 60's, 5s. 3d. MANCHESTER : Crystals, 1s· 1d. to 1s. 3d. per lb., d/d crude, 5s. 4d., naked, at works.

Creosote.—Home trade, 8d. to 10½d. per gal., according to quality, f.o.r. maker's works. MANCHESTER : 6¼d. to 9¾d. per gal.

Cresylic Acid.—Pale 98%, 4s. 7d. per gal. ; 99.5/100%, 5s. 0d. American, duty free, for export, 9s. 0d., naked at works. MANCHESTER : Pale, 99/100%, American, duty free, 7s. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots ; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra : higher prices for smaller lots.

Naphthalene.—Crude, ton lots, in sellers' bags, £17 to £20 per ton according to m.p. ; hot-pressed, £50 to £60 per ton, in bulk ex works ; purified crystals, £60 to £70 per ton. F.O.B.

Pitch.—Medium, soft, home trade, 115s. per ton f.o.r. suppliers' works ; export trade, 135s. per ton f.o.b. suppliers' port. MANCHESTER : £6 15s. f.o.r.

Pyridine.—90/160°, 27s. 6d. per gal. MANCHESTER : 26s. to 30s. per gal.

Toluol.—Pure, 3s. 2¼d. per gal. MANCHESTER : Pure, 3s. 2d. per gal. naked.

Xylol.—For 1000-gal. lots, 4s. 0½d. to 4s. 3d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton ; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d. per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d. to 5s. 6d. per gal. ; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediate and Dyes
(Prices Nominal)

m-**Cresol** 98/100%.—3s. 6d. per lb. d/d.

o-**Cresol** 30/31° C.—9½d. per lb. d/d.

p-**Cresol** 34/35° C.—3s. 6d. per lb. d/d.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb. ; 66/68° C., 1s.

p-**Nitraniline.**—2s. 11d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

Nitronaphthalene.—1s. 2d. per lb. ; P.G. 1s. 0½d. per lb.

o-**Toluidine.**—1s. per lb., in 8/10-cwt. drums, drums extra.

p-**Toluidine.**—2s. 2d. per lb., in casks.

m-**Xylidine Acetate.**—4s. 5d. per lb., 100%.

NIVOC

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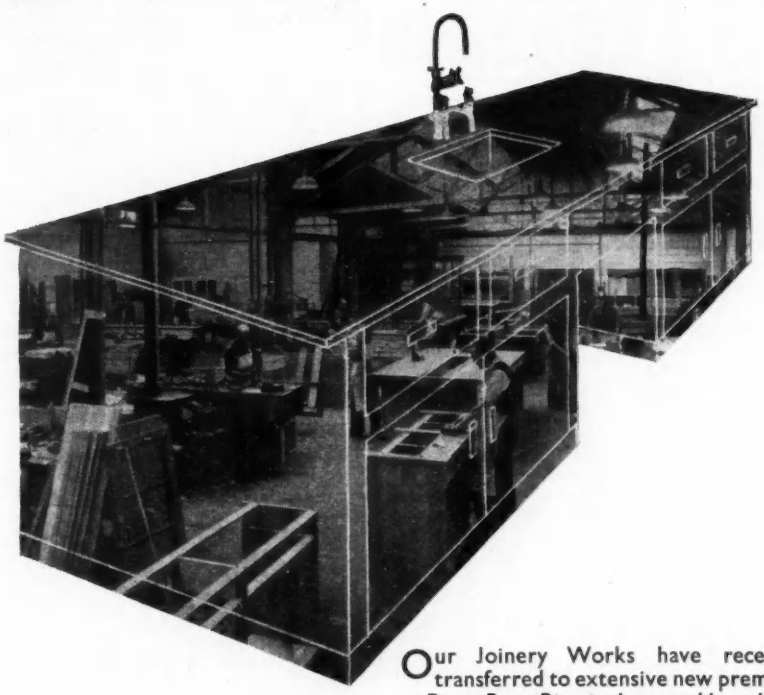

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FS

Chemical & Allied Stocks & Shares

THE strength and activity which developed in stock markets following the Budget, and the stimulus of dividend increases from many well-known companies, have now given way to a more cautious attitude. Developments in Persia and international affairs have affected sentiment, and moreover, there are growing doubts whether many companies will be able to maintain profits at 1950 levels, having regard to mounting costs and shortages of materials. It is true, of course, that in recent weeks prices of some commodities, notably wool, rubber and tin, have reacted from the record high levels touched earlier in the year. On the other hand, U.S. stockpiling needs will cause a renewed uptrend in prices unless the U.S. visit of Mr. Stokes, the Lord Privy Seal, results in a workable scheme for allocating essential materials between the countries of the United Nations. The fact that many of Britain's big industrial giants, including Imperial Chemical and Dunlop Rubber, have raised their dividends, suggests reasonable confidence in the future. On the other hand, in numerous cases the financing of stocks is creating a problem owing to rising prices.

As was to be expected, chemical and kindred shares moved closely with the general trend of markets over the month. Earlier big gains have been followed by moderate profit-taking. Imperial Chemical, which a month ago were up to 52s. on the big profit increase and higher dividend of 12 per cent, have now come back to 50s. "ex" the final dividend. The full report mentions that last year there was further expansion both in the value and volume of the company's sales. The total value of the sales of the group to customers at £220,800,000 was the highest in its history. Revaluation of the group's manufacturing assets which has revealed a surplus of £96,000,000 and has been added to special reserves, has been on the basis of estimated present day cost of construction, reduced to take account of their age, not on the basis of present-day replacement of these assets in a new condition.

Albright & Wilson 5s. shares have strengthened to 21s. 3d., Boake Roberts were good at 37s. on the share bonus news, and Brotherton 10s. shares have kept steady around 24s. 4½d. since publication of the financial results. Fisons were good at 29s., the favourable yield attracting buyers, while Monsanto 5s. units at 26s. 6d. were "ex" the share bonus and firm on the full report which emphasises the progressive policy being followed by the group. Laporte 5s. units were active up to 12s. 9d., but later eased to 12s. 6d. F. W. Berk 2s. 6d. shares were 7s. 1½d., Bowman Chemical 5s. 9d., Amber Chemical 2s. shares changed hands around 1s. 9d. and Lawes Chemical have risen to 16s. Major & Co.'s 2s. shares were 3s. 9d. W. J. Bush £1 ordinary have been firm at £6. William Blythe 3s. shares changed hands around 11s. 3d. In other directions, Borax Consolidated have been fairly steady around 37s., British Glues & Chemicals strengthened to 26s. 6d. on higher dividend talk, and there was again a substantial business in Glaxo Laboratories, which, however, at 73s. 3d. did not fully keep best prices. The market is continuing to take the view that when the latter company needs more capital it is likely to be raised by an offer of shares to shareholders on attractive terms. Reports of increased business have drawn attention to plastics and kindred shares. British Xylonite were 90s., Kleemann 1s. shares 14s., De La Rue 28s. 6d., and British Industrial Plastics 2s. shares 7s. 7½d.

Next Week's Events

MONDAY 28 MAY

Incorporated Plant Engineers

Leeds: Fuel Department, Leeds University, 7.30 p.m. Dr. Irvine: 'Recent Developments in Metallurgy.'

WEDNESDAY 30 MAY

The Chemical Council

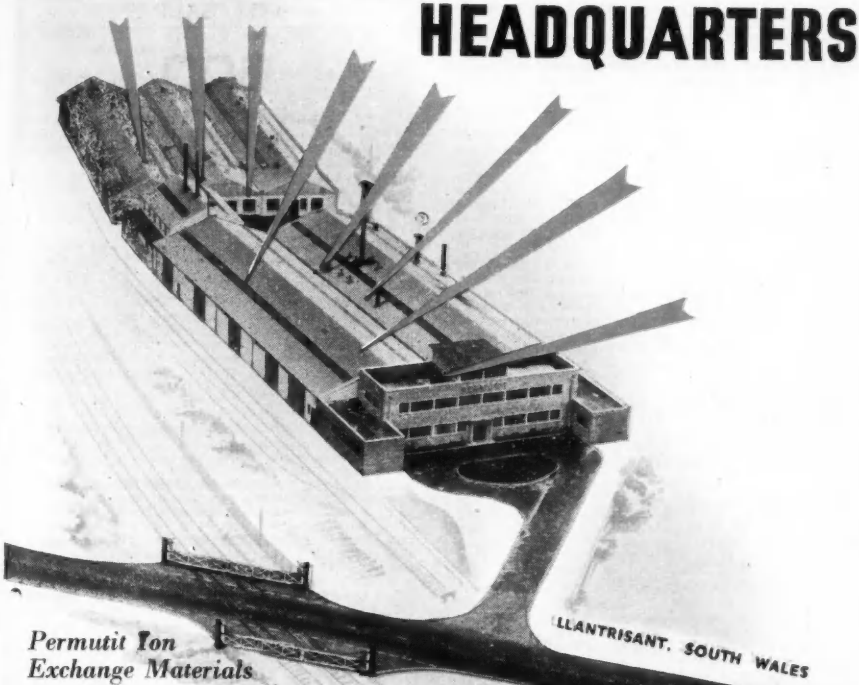
London: The Royal Institution, Albemarle Street, W.1, 6 p.m. Professor J. W. Cook: 'Chemistry and the Conquest of Disease'. Third in a Festival series on 'Chemistry in the Service of Man'.

FRIDAY 1 JUNE

Society of Public Analysts

London: National Institute for Medical Research, The Ridgeway, Mill Hill, N.W.7. Biological Methods Group—2 p.m. Three Papers; 4 p.m. Five Demonstrations.

ION EXCHANGE HEADQUARTERS



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In this modern factory, Permutit manufactures ion exchange materials of all types. Some are used extensively in water treatment: others assist diverse industrial processes by reducing running costs and speeding production. There's undoubtedly a job for Permutit ion exchange in your industry and it will pay you to ask for more details.

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A **CHEMICAL PLANT MANAGER** is required by Laporte Chemicals Limited at their Luton Works. Applicants should have an Honours Degree in Chemistry or Chemical Engineering or the equivalent. Some industrial experience, though not essential, would be of advantage. The work involved is in a rapidly developing field of organic peroxide manufacture and the wide range of the Company's products offers considerable scope for the right man. A pension scheme is in operation. The salary offered will be in accordance with qualifications and experience. Apply to **Works Manager, Laporte Chemical Limited, Kingsway, Luton, Beds.**, giving details of age, education, qualifications and experience.

CHEMICAL ENGINEER. Well known and expanding Anglo-American engineering and contracting firm in City of London requires Chemical Engineer with Honours Degree or its equivalent, together with some refinery and/or industrial experience. The position presents excellent prospects for candidate possessing, in addition to the required academic qualificaions and experience, the ability to express his thoughts and ideas both orally and in reports, and a keen desire to keep abreast of latest developments in this profession, both theoretically and practically. Good starting salary commensurate with qualifications and age. Write in strict confidence giving full details of education, qualifications, experience, age and present salary, to **Box Z.D. 399, Deacon's Advertising, 36 Leadenhall Street, London, E.C.3.**

GRADUATES in Mechanical, Mining or Chemical Engineering are offered opportunities overseas in the Production Department of the Kuwait Oil Company. Age under 30. Starting £710 p.a. clear plus generous living allowances. Kit allowance, pension scheme. Write giving full details to **Box "H.G." c/o J. W. Vickers & Co., Ltd., 7/8 Great Winchester Street, London, E.C.2.**

THE Civil Service Commissioners give notice that an Open Competition for pensionable appointment to the **ASSISTANT (SCIENTIFIC) CLASS (BASIC GRADE)**, will be held during 1951. Interviews will be held throughout the year, but a closing date for the receipt of applications earlier than December, 1951 may eventually be announced either for the competition as a whole or in one or more subjects. Successful candidates may expect early appointments.

Candidates must be at least 17½ and under 26 years of age on 1st January 1951, with extension for regular service in H.M. Forces, but other candidates over 26 with specialized experience may be admitted. All candidates must produce evidence of having reached a prescribed standard of education, particularly in a science subject and of thorough experience in the duties of the class gained by service in a Government Department or other civilian scientific establishment or in technical branches of the Forces, covering a minimum of two years in one of the following groups of scientific subjects :

(i) Engineering and physical sciences.
(ii) Chemistry, bio-chemistry and metallurgy.
(iii) Biological Sciences.
(iv) General (including geology, meterology, general work ranging over two or more groups (i) to (iii) and highly skilled work in laboratory crafts such as glass-blowing.)

Salary according to age up to 25 : Men, £215 (at 18) to £330 (at 25)-£455 ; rather less in the provinces and for women. Opportunities for promotion.

Further particulars and application forms from **Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London, W.1, quoting No. S 59/51.** Completed application forms should be returned as soon as possible.
10673/300/JC.

FOR SALE

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CHEMICAL PLANT

TWIN pot type **PEBBLE MILL** with two 2 gal. containers. Motorized 400/3/50. Grinding media included.

2 steam jacketed **ROTARY VACUUM DRYERS,** each 17 ft. 3 in. by 4 ft. 6 in. diam. Manhole in barrel with cover. Mounted on roller tracks and driven through glanded trunnion bearings. Discharge through S.J. chamber.

TWIN ROLL FLAKING M/C by Bertram, with C.I. rolls 60 in. by 28 in. diam. Drive through helical gearing from 4 ½-h.p. reduction gear box ratio 160-35. Rolls suitable for 40 lb. pressure.

TUNNEL KILN by Incandescent Heat Co. Effective length 104 ft. 11 in. Overall length of Pusher Gear, etc. 130 ft. Three zone temperature control with Foster Instrument Panel, Pusher Gear Fans, trunking, etc. Arranged for gas firing, suitable max. temperature 1400°C. Working width tunnel 3 ft. 10 in. Including 32 bogies.

2 vert. cyl. **MIXERS,** 3 ft. diam by 6 ft. 8 in. deep, on straight with 9 in. cone bottom to 2 in. diam. outlet. Vert. shaft, propellor type agitators. 2¼ in. o.d. int. steam coils. Vessels T/E. flat bolted cover with 3 in. and two 1 in. connections. 15 in. diam. manhole in side.

Horizontal single trough **STEAM JACKETED MIXERS** by Scott. 14 in. long by 4 ft. 6 in. deep by 4 ft. 6 in. wide. Of rivetted M.S. W.P. 50 lb. sq. in. Totally enclosed with 24 in. by 18 in. manhole in cover. F. and L. pulley drive, through worm gearing.

Horizontal **TROUGH MIXER** 18 in. by 19 in. by 25 in. deep with gate type agitator. Hand tilting. Motorized 400/3/50.

2 **FILTER PRESSES** by S. H. Johnson. Plate and frame type, 69 chambers forming cakes 33 in. sq. Individual plate discharge. Hand op. closing gear.

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CHARCOAL (vegetable) for sale, as follows : 22 tons oak, 18 tons hazel, 14 tons ash, 10 tons birch, 5 tons each alder, beech and willow. All carefully made and in excellent condition. Write **Box 493, Smiths' 100 Fleet Street, E.C.4.**

3 M.S. Welded Jacketed **PANS,** 24 in. diam by 26 in. deep, 1½ in. bottom outlet, mounted on angle legs. Tested 100 lb. hydraulic pressure.

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VARIOUS MIXERS FOR SALE

BAND CONVEYOR, 50 ft. long 40 in. wide, steel frame motorised, for boxes, cases, bags, etc.

A FILTER PRESS, 31½ in. square, fitted with 42 C.I plates, centre fed.

1½, 2½ and 3½ size belt-driven **DISINTEGRATORS** by Christy & Norris or Harrison Carter.

Size No. 3 Junior Hammamac **HAMMER MILL** with fan and cyclone, also No. 1 size Miracle **GRINDING MILLS** and one size 3W Miracle **GRINDING MILL.**

Robinson 3-sheet No. 1 size **CENTRIFUGAL DRESSING MACHINE** for dry powders, etc.

Gardner Size "G" **RAPID SIFTER** and **MIXER,** belt and gear driven.

Two Gardner **RAPID MIXERS** only, 40 in. long, 14 in. wide, one provided with small separate A.C. Motor.

Four **ROTARY BOWL MIXERS,** 5 ft. diam., cast iron built, inclined agitators, by Baker Perkins.

One Broadbent under-driven **HYDRO EXTRACTOR** self-balancing type, with self-contained A.C motor.

Two **FILTER PRESSES,** fitted recessed C.I. plates, 40 in square, 2½ in. thick, centre fed, to make 11 cakes per Press.

One Lilleshall **FILTER PRESS,** fitted 18 C.I. plates, 36 in square, and 19 C.I. frames, with side inlet, side enclosed delivery and usual fittings.

Kek **GRINDING MILL,** square pin type, with grinding discs 13 in. diam., including circular delivery bin with single outlet.

Large unjacketed **WERNER MIXER,** belt and gear driven, hand tipping, double "Z" arms, pans 53 in. by 45 in. by 36 in. deep.

No. 200 One nearly new **WERNER PFLEIDERER JACKETED MIXER OR INCOPORATOR.** Low type, with C.I. built mixing chamber, 28 in. by 29 in. by 27 in. deep, with double "U"-shaped bottom which is jacketed, and double fish-tail or fin-type agitators geared together at one side, with belt-driven friction pulleys, 34 in. diam. by 5 in. face, with hand-wheel operation and hand-operated screw tilting gear. Machine fitted with machine-cut gears covers, gear guard, cast-iron baseplate, and measuring overall approximately 7 ft. by 6 ft. by 4 ft. high to the to of the tipping screw

No. 209 One **HORIZONTAL 'U"-SHAPED MIXER,** steel built, riveted, measuring about 8 ft. 3 in. long by 3 ft. wide by 3 ft. 3 in. deep, with horizontal shaft, fitted with bolted-on mixing arms about 18 in. long by 4 in. wide, with intermediate breakers, and driven at one end by a pair of spur gears, with countershaft, fast and loose belt pulleys, outer bearing and plug cock type outlet at the opposite end, mounted on two cradles fitted to two R.S.J. running from end to end.

Further details and prices upo application

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"CHEMICALS, PIGMENTS, METAL POWDERS." **Dohm, Ltd.,** 167, Victoria Street, S.W.1.

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MORTON, SON & WARD LIMITED
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THREE 200g stainless steel rectangular **TANKS,** new and unused.
TWO 60 g and ONE 50g jacketed **BOILING PANS,** can be arranged with mixing gear.
TWO 100g mild steel jacketed **BOILING PANS.**
'Morward' **TROUGH MIXERS,** 4 ft., 6 ft. and 8 ft., arranged with scroll type mixing gear, electrically driven or fast and loose pulley, hand wheel operated discharge.
2 in. Drysdale PUMPS, all gun metal, stainless steel shafts, 2,000 g.p.h. at 50 ft. head.
TWO 6 in. acid resisting cast steel non clog, Slurry type **PUMPS,** direct coupled to electric motor, mounted on common bedplate, 10,000 g.p.h. at 150 ft. head.
Numerous sizes all bronze, brass tube **CONDENSERS** and **HEAT EXCHANGERS.**
HYDRO EXTRACTORS. A large selection from 72 in. to 30 in. all electric.
Several Hopkinson's **CENTRIFUGES** for separating in stock.

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Several Lacy-Hulbert **VACUUM PUMPS,** from size 0.
Vertical Egg-ended **PRESSURE VESSELS,** 5 ft. by 12 ft. 6 in. 100 lb. p.s.i., ¼ in. plate.
Unused Baird & Tatlock, 8 gallon **REFRACTIONATING VACUUM STILL.**

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TEN- Shallow **ALUMINIUM TANKS,** 30 up to 125 gallons.
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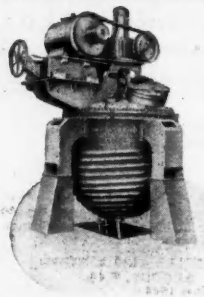

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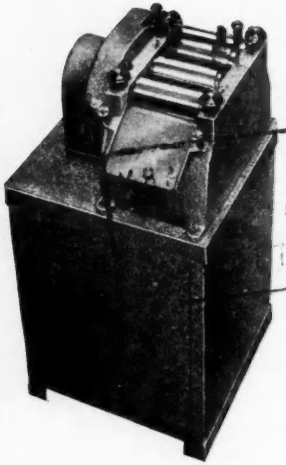

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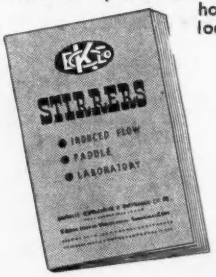

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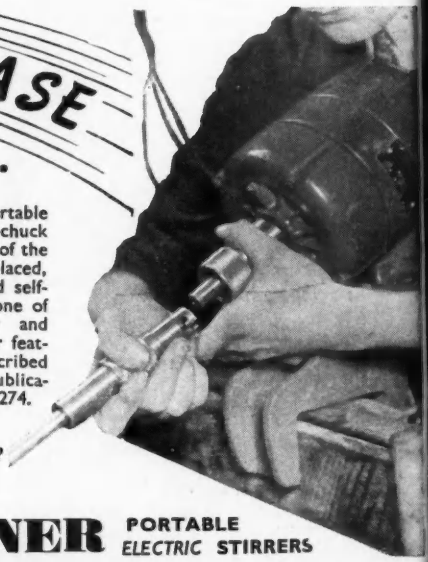

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